Draft Date: February 16, 2001

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Colonel James W. DeLony
District Engineer, Wilmington District. Army Corps of Engineers
Post Office Box 1890
Wilmington, North Carolina 28402-1890

Subject: **Draft** Biological/Conference opinion on the effects of the Ocean Isle Beach Project on seabeach amaranth, manatee, loggerhead and green sea turtles, and piping plover.

Dear Colonel DeLony:

This document transmits the U.S. Fish and Wildlife Service's (Service) draft biological and conference opinion (opinion) based on our review of the proposed beach erosion control and hurricane wave protection project located on Ocean Isle Beach in Brunswick County, North Carolina, and its effects on seabeach amaranth, the West Indian manatee, loggerhead and green sea turtles, and the Great Lakes, Atlantic Coast, and Northern Great Plains piping plover populations in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. § 1531 et seq.). We received your October 17, 2000 request for formal consultation on October 20, 2000.

This opinion is based on information provided in the June 1997 Environmental Assessment (EA), the October 1997 Finding of No Significant Impact (FONSI), available literature, personal communications, and other sources of information. A complete administrative record of this consultation is on file in the Ecological Services Field Office in Raleigh, North Carolina.

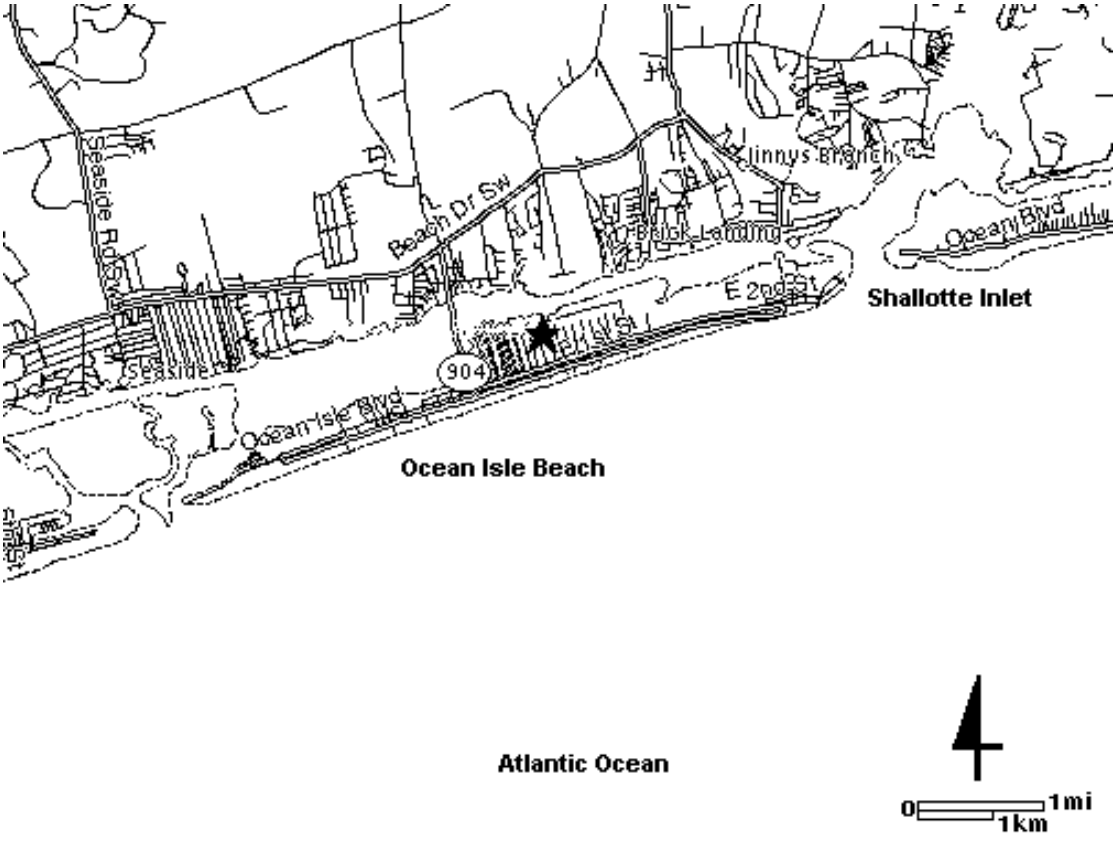
Consultation History

On October 17, 2000, the U.S. Army Corps of Engineers (Corps) submitted a letter to the Service requesting initiation of formal consultation and the preparation of an opinion for the proposed beach erosion control and hurricane wave protection project located on Ocean Isle Beach in Brunswick County, North Carolina (hereafter referred to as Ocean Isle Beach Project). An Environmental Assessment for the proposed project was completed in June 1997; a FONSI was completed in October 1997. Formal consultation concluded on January 15, 2001.

BIOLOGICAL OPINION

I. Description of the Proposed Action

A. Location map (see page)



The proposed project is located on Ocean Isle Beach in Brunswick County, North Carolina. The purpose of the project is to provide annual beach nourishment along the project area due to hurricanes, extra tropical storms and beach erosion.

B. Project Design

The proposed project consists of dredging Shallotte Inlet using an ocean-certified hydraulic pipeline dredge and disposing of dredge sediments on Ocean Isle Beach in three main fill segments.

Segment 1 is a dune and berm fill extending from Station 51+50 to Station 103+00 (5,150 ft, 1,566 m). The top of dune elevation is 9.5 ft (2.8 m) National Geodetic Vertical Datum (NGVD), with a 50 ft (15.1 m) wide berm extending seaward from the dune toe. The constructed dune template will tie into the existing dunes, with the existing dunes staying in place. The dune template starts 40 ft inland from the natural vegetation line at elevation 7 ft (2.1 m) NGVD. The landward slope of the dune is 5 horizontal to 1 vertical, the top of dune width is 25 ft, and the seaward slope is 10 horizontal to 1 vertical. The berm elevation is 7 ft (2.1 m) NGVD. Below 7 ft (2.1 m) NGVD, the with-project profile is assumed to parallel the natural profile out to a closure depth of -26 ft (7.9 m) NGVD.

Segment 2 is the 50 ft (15.1 m) berm portion of the main fill, and extends from Station 103+00 to Station 129+00 (2,600 ft, 788 m). The berm-only templates (Segment 2 and Segment 3) extend seaward from the existing profile at elevation 7 ft NGVD. Below 7 ft (2.1 m) NGVD, the with-project profile is assumed to parallel the natural profile out to a closure depth of -26 ft (7.9 m) NGVD.

Segment 3 is the 25 ft (7.6 m) berm segment of the project, and extends from Station 129+00 to Station 153+00 (2,400 ft, 727 m).

In addition to the main fill described above, the project includes a 4,200 ft (1,273 m) long transition on the east end, from Station 9+50 to Station 51+50; and a 2,800 ft (848 m) long transition on the west end, from Station 153+00 to Station 181+00. This gives a total project length (including transitions) of 17,150 ft (5,197 m) or about 3.25 miles (5.2 km).

The constructed dune will be vegetated, including both the foreslope and backslope of the dune. The vegetation will be comprised of American beach grass (*Ammophila breviligulata*) and sea oats (*Uniola*

paniculata) planted in designated patterns.

Approximately 1.6 million cubic yards of beach quality sand are available for project construction from Shallotte Inlet. The proposed dredging cut for initial construction will follow the natural flow of the inlet, and will create a 15 ft (4.6 m) deep channel with three horizontal to one vertical side slopes measuring approximately 150 ft (45.5 m) wide at the Atlantic Intracoastal Waterway (AIWW) and 1,400 ft (424 m) wide at the bar channel. An average volume for three-year maintenance sediment disposal is estimated to about 300,700 cubic yards available from Shallotte Inlet.

C. Project Timing and Duration

The proposed work is scheduled to begin in late February or early March 2001 and will require approximately four to six months to complete, including time for mobilization and demobilization. Each three year maintenance sediment disposal cycle will take approximately three months. The life of the project is 50 years.

D. Conservation Measures

To reduce the potential impacts of the proposed project on Federally-protected species, the Corps has offered the following conservation measures:

(1) implement a sea turtle nest monitoring and relocation program between May 1, 2001 and will continue until the end of the nesting season or until all work is completed. A knowledgeable contractor with current permits will perform the work;
(2) assure that the entire restored portions of the beach are in permanent public ownership;
(3) time project to occur during the dormant season (December - May) for seabeach amaranth. The Corps will annually monitor the project area as part of the Annual Seabeach Amaranth Monitoring Program and will coordinate work performed during the seabeach amaranth growing season with the USFWS;
(4) monitor beach compaction and escarpments and conduct tilling and grading, if necessary, immediately following the beach disposal operation;. If tilling or grading of escarpments are necessary in the interim, the work will be performed by Ocean Isle Beach;
(5) implement a shoreline monitoring program to determine if any modifications in project operation are necessary to avoid adverse impacts on adjacent beaches;
(6) extend wooden walkways to the beach at public beach access points within the limits of the proposed project.

II. Status of the Species/Critical Habitat

Species/Critical Habitat Description

Seabeach Amaranth

Seabeach amaranth (*Amaranthus pumilus*) was listed as threatened under the Act on April 7, 1993 (58 FR 18035). The species currently ranges from South Carolina to New York; although, North Carolina is presently considered a stronghold for the species (Weakley and Bucher, 1992). There is no designation of critical habitat for seabeach amaranth.

West Indian Manatee

The West Indian manatee (*Trichechus manatus*) was listed as endangered under the Act on March 11, 1967 (32 FR 4001). Additional Federal protection is provided for this species under the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. § 1461 et seq.). The United States' manatee population is confined during the winter months to the coastal waters of the southern half of peninsular Florida and to springs and warm water out-falls as far north as southeast Georgia (USFWS, 1996c). However, during the summer months, they may migrate as far north as coastal Virginia on the east coast and the Louisiana coast on the Gulf of Mexico. Manatee populations also exist outside the continental United States in coastal areas of the Caribbean and Central and South America (Odell, 1992). There is no critical habitat designated for the West Indian manatee in North Carolina.

Sea Turtles

Of the sea turtle species that are found in United States waters or that nest on United States beaches, only loggerhead and green sea turtles have nested on beaches in the vicinity of the proposed project.

Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*), listed as threatened under the Act on July 28, 1978 (43 FR 32800), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea turtles nest within the continental United States from Louisiana to Virginia. Major nesting concentrations in the United States are found on the coastal islands of North Carolina, South Carolina, and Georgia and along the Atlantic and Gulf coasts of Florida (Hopkins and Richardson, 1984). There is no critical habitat designated for the loggerhead sea turtle in North Carolina.

Green Sea Turtle

The green sea turtle (*Chelonia mydas*) was federally listed as a protected species on July 28, 1978 (43 FR 32800). Breeding populations of the green turtle in Florida and along the Pacific Coast of Mexico are listed as endangered; all other populations are listed as threatened. The green turtle has a worldwide

distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Atlantic Green turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida (NMFS and USFWS, 1991a). Green turtles have also been known to nest in Georgia (Georgia Department of Natural Resources, unpubl. data), but only on rare occasions, and sporadically in South Carolina (South Carolina Department of Natural Resources, unpubl. data) and North Carolina [North Carolina Wildlife Resources Commission (NCWRC), unpubl. data]. There is no critical habitat designated for Atlantic green turtles in North Carolina.

Piping Plover

The piping plover (*Charadrius melodus*) breeds in only three geographic regions of North America – the Great Lakes; the Northern Great Plains; and the Atlantic Coast. The Great Lakes population was designated as endangered and the Northern Great Plains and Atlantic Coast populations were designated as threatened under the Act on December 11, 1985 (50 FR 50726). Piping plovers from all three breeding populations winter along southern Atlantic, Gulf Coast, and Caribbean beaches and barrier islands, where they are classified as threatened under the Act. The Service proposed to designate critical habitat for wintering piping plovers on July 6, 2000 (65 FR 41782).

In 1986, the Service appointed two recovery teams to develop recovery plans for the Atlantic Coast (USFWS, 1988a; 1996a) and Great Lakes/Northern Great Plains (USFWS, 1988b; 1994) breeding populations. Responsibility for recovery of the Great Lakes and Northern Great Plains populations was subsequently divided, and separate revised recovery plans for those two populations are currently in preparation (USFWS, 2000b). The recovery plan for the Atlantic Coast plover identifies four recovery units – New England (Maine to Rhode Island), New York-New Jersey, Southern (Delaware, Maryland, Virginia, North Carolina), and Atlantic Canada – for management and recovery purposes (USFWS, 1996a).

C. Life History

Seabeach Amaranth

Seabeach amaranth is an annual plant that grows on Atlantic barrier islands and ocean beaches, primarily in disturbed areas such as overwash flats, accreting areas near inlets, and on lower foredunes and upper strands of noneroding beaches, and may serve as a dune-building pioneer species. The stems are fleshy and pink-red or reddish, with small rounded leaves that are 0.5 to 1.0 inches (1.3 to 2.5 cm) in diameter. The leaves are clustered toward the tip of the stem, are normally a spinach-green color, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous, borne in clusters along the stems. Germination occurs over a relatively long period of time, generally from April to July. Upon germinating, this plant initially forms a small unbranched sprig, but soon begins to branch profusely into a

clump. This clump often reaches one foot (0.3 m) in diameter and consists of 5 to 20 branches. Occasionally, a clump may get as large as three feet (0.9 m) or more across, with 100 or more branches.

Flowering begins as soon as plants have reached sufficient size, sometimes as early as June, but more typically commencing in July and continuing until the death of the plant in late fall. Seed production begins in July or August; it reaches a peak in September during most years, but continues until the death of the plant. Weather events, including rainfall, hurricanes, and temperature extremes, and predation by webworms have strong effects on the length of seabeach amaranth's reproductive season. As a result of one or more of these influences, the flowering and fruiting period can be terminated as early as June or July. Under favorable circumstances, however, the reproductive season may extend until January or sometimes later (Radford et al., 1968; Bucher and Weakley, 1990; Weakley and Bucher, 1992).

West Indian Manatee

The West Indian Manatee is an aquatic herbivore that primarily consumes aquatic vegetation such as seagrasses and bank grasses; however, they will occasionally feed on fish. Manatees may spend about 5 hours a day feeding, and may consume 4 to 9 percent of their body weight a day (USFWS, 1995). Adult manatees average about 11 feet long (3.5 m) and weigh as much as 2,200 pounds (998 kg) (USFWS 1996c). Males and females are similar in size and appearance, but are distinguished by the position of the genital openings and the presence or absence of mammary glands.

Observations of mating herds indicate that females mate with a number of males during their two- to four-week estrus period, and then they go through a pregnancy estimated to last 12 to 14 months (USFWS 1996c). Births occur during all months of the year with a slight drop during the winter. Mature females may give birth to a single calf every two to five years, but 1.5 percent of births are twins. Calves reach sexual maturity at three to six years of age. The only long-term, stable bond between manatees is that between a cow and her calf. Weaning generally occurs between 9 and 24 months of age, although a cow and calf may continue to associate with each other for several more years. There is little information on the life-time reproductive output of females, although they may live over 50 years (Odell, 1982).

Sea Turtles

During the nesting season (May through October) female sea turtles come ashore to lay their eggs in pits excavated using their fore and rear flippers. Females lay from 50 to 120 eggs per nest that will incubate for about 50 to 70 days before hatching and proceeding to the water. Hatchlings will swim offshore until they reach the safety of protective floating seaweed. There they will remain until they reach a certain age or size at which time they return to nearshore waters. When they reach reproductive age, adult females return to the same beaches where they were hatched to lay their eggs. The large numbers of offspring produced help compensate for the high natural mortality of the young during their first several

years of life.

Loggerhead Sea Turtle

Adult loggerheads average three feet (0.9 m) in length and weigh an average of 250 lbs. (113 kg). Hatchlings measure approximately 1.75 inches (45 mm) in length and weigh approximately three quarters of an ounce (20 g). Age at sexual maturity is believed to be about 20 to 30 years (Turtle Expert Working Group, 1998). Mating takes place in late March-early June, and eggs are laid throughout the summer. Loggerheads are known to nest from one to seven times within a nesting season (Talbert et al., 1980; Lenarz et al., 1981; Richardson and Richardson, 1995); the mean is approximately 4.1 (Murphy and Hopkins, 1984). The internesting interval varies around a mean of about 4.1 days (Dodd, 1988). Mean clutch size varies from about 100 to 126 along the southeastern United States coast (NMFS and USFWS, 1991b). Remigration intervals of two to three years are most common in loggerheads, but the number can vary from one to seven years (Dodd, 1988).

Green Sea Turtle

Adult green sea turtles commonly reach a size greater than three feet (0.9 m) in length and weigh 330 lbs. (150 kg). Hatchlings weigh nearly an ounce (25 g) and are about two inches (50 mm) long. Age at sexual maturity is estimated at 20 to 50 years (Hirth, 1997). Green sea turtles deposit from one to nine clutches within a nesting season, but the overall average is about 3.3 clutches. The internesting interval varies around a mean of 13 days (Hirth, 1997). Mean clutch size varies widely among populations; average clutch size reported for Florida was 136 eggs in 130 clutches (Witherington and Ehrhart, 1989). Only occasionally do females produce clutches in successive years. Usually two, three, four, or more years intervene between breeding seasons (NMFS and USFWS, 1991a).

Piping Plover

Piping plovers are small, sand-colored shorebirds approximately seven inches (17 cm) long with a wingspan of about 15 inches (38 cm) (Palmer, 1967). Breeding birds have a single black breastband, a black bar across the forehead, bright orange legs and bill, and a black tip on the bill. During winter, the birds lose the black bands, the legs fade to pale yellow, and the bill becomes mostly black.

Great Lakes piping plovers nest on sparsely vegetated beaches, cobble pans, or sand spits of sand dune ecosystems along the Great Lakes shorelines. Atlantic Coast plovers nest on coastal beaches, sand flats at the ends of sand spits and barrier islands, gently sloped foredunes, sparsely vegetated dunes, and washover areas cut into or between dunes. Plovers in the Northern Great Plains make their nests on sand flats or bare shorelines of rivers and lakes, including sparsely vegetated sandbars on the upper Missouri River system, and patches of sand, gravel, or pebbly-mud on the alkali lakes. Piping plovers from all three breeding populations winter along South Atlantic, Gulf Coast, and Caribbean beaches and

barrier islands, primarily on intertidal beaches with sand and/or mud flats with no or very sparse vegetation.

Plovers arrive on the breeding grounds from mid-March through mid-May and remain for three to four months per year; the Atlantic Coast plover breeding activities begin in March in North Carolina with courtship and territorial establishment (Coutu et al., 1990; McConnaughey et al., 1990). Egg laying begins around mid-April with nesting and brood rearing activities continuing through July. They lay three to four eggs in shallow scraped depressions lined with light colored pebbles and shell fragments. The eggs are well camouflaged and blend extremely well with their surroundings. Both sexes incubate the eggs which hatch within 30 days, and both sexes feed the young until they can fly. The fledgling period, the time between the hatching of the chicks and the point at which they can fly, generally lasts 25 to 35 days. Plovers depart for the wintering grounds from mid-July through late October. Breeding and wintering plovers feed on exposed wet sand in wash zones; intertidal ocean beach; wrack lines; washover passes; mud-, sand-, and algal flats; and shorelines of streams, ephemeral ponds, lagoons, and salt marshes by probing for invertebrates at or just below the surface (Coutu et al., 1990; USFWS, 1996a). They use beaches adjacent to foraging areas for roosting and preening. Small sand dunes, debris, and sparse vegetation within adjacent beaches provides shelter from wind and extreme temperatures.

D. Status and Distribution

Seabeach Amaranth

Seabeach amaranth is currently known from 13 populations in New York, 34 populations in North Carolina, and eight populations in South Carolina (USFWS, 1996b). Seabeach amaranth has been eliminated from two-thirds of its historic range, and most of the remaining populations are small and vulnerable to extirpation. North Carolina has the only remaining large populations (Weakley and Bucher, 1992).

Reason for Listing: Seabeach amaranth has been and continues to be threatened by destruction or adverse alteration of its habitat, and as a fugitive species dependent on a dynamic landscape and large-scale geophysical processes, it is extremely vulnerable to habitat fragmentation and isolation of small populations. Further, because this species is easily recognizable and accessible, it is vulnerable to taking, vandalism, and the incidental trampling by curiosity seekers. No evidence of disease has been seen in seabeach amaranth; however, predation by webworms is a major source of mortality and lowered fecundity. Seabeach amaranth is afforded legal protection in North Carolina by the General Statutes of North Carolina, Secs. 106-202.15, 106- 202.19 (N.C. Gen. Stat. section 106 (Supp. 1991)), which provide for protection from intrastate trade (without a permit).

Historically, seabeach amaranth occurred in 31 counties in 9 States from Massachusetts to South Carolina. It has been eliminated from six of the States in its historic range. Most of the remaining

populations are small, and the species appears vulnerable to extirpation in two (South Carolina and New York) of the three States in which it remains.

Range-wide Trend: In September of 1989, Hurricane Hugo struck the Atlantic coast near Charleston, South Carolina, causing extensive flooding and erosion north to Cape Fear, North Carolina, with less severe effects extending northward throughout the range of seabeach amaranth. This was followed by several severe Northeasters in the winter of 1989-1990 and by Hurricane Bertha in the late summer of 1990. These last storms, although not as significant as Hurricane Hugo, caused substantial erosion of many barrier islands in the heart of seabeach amaranth's remaining range. The 1990 surveys revealed that the effects of these climatic events were substantial (Weakley and Bucher, 1992).

In the Carolinas, populations of amaranth were severely reduced. In South Carolina, where the effects of Hurricane Hugo and subsequent dune reconstruction were extensive, amaranth numbers went from 1,800 in 1988 to 188 in 1990, a reduction of 90 percent. A 74 percent reduction in amaranth numbers occurred in North Carolina, from 41,851 plants in 1988 to 10,898 in 1990. Although population numbers in New York increased in 1990, range-wide totals were reduced 76 percent from 1988 (Weakley and Bucher, 1992).

Most of the largest remaining populations are located on publicly owned land, including Cape Hatteras and Cape Lookout National Seashores, in North Carolina. At these sites, the plants are being protected from beach armoring and shoreline stabilization, the single most serious threat to the species' continued existence. Off-road vehicle traffic has also been routed around areas where plants are growing on National Park Service lands. Collection and storage of seeds and plant material has begun in cooperation with the Center for Plant Conservation and its member gardens.

New Threats: The most serious threats to this species' continued existence are construction of beach stabilization structures, natural and man-induced beach erosion and tidal inundation, fungi (i.e., white wilt), beach grooming, herbivory by insects and feral animals, and off-road vehicles.

West Indian Manatee

Reason for Listing: The manatee population was probably more abundant in the 18th or 19th century than today. Initial population decreases probably resulted from over harvesting for meat, oil, and skins (USFWS, 1980). Today hunting is prohibited and is not considered a problem, although there is an occasional incidence of poaching. Heavy mortality does occur, however, from accidental collisions with boats and barges, and from canal lock operations. Another closely related factor in the decline of the species has been the loss of suitable habitat through incompatible coastal development, particularly the destruction of seagrass beds. The combination of high mortality rates and low reproductive rates have led to serious doubts about the species' ability to survive in the United States.

Range-wide Trend: Manatee population trends are poorly known and determining exact population estimates is difficult (USFWS 1996c). Aerial surveys over past years show an increase in numbers; however, they may not be an accurate account of trends (USFWS 1999.). For example, surveys conducted in February, 1996 determined that 2,639 manatees were in Florida's waters. In 1997, surveys in January and February determined that 2,229 and 1,709 individuals, respectively, were present. Further, there was no evidence of increase or decrease in the population numbers between the 1970s and 1980s (USFWS 1999). Because of the variation and uncertainty in surveying (i.e., manatee behavior, surveying methodology, weather conditions, etc.), it is difficult to correlate population estimates with population trends.

Despite the lack of accurate estimates, human activities have significantly affected manatees. Modifying suitable habitat, altering migratory routes, and increasing mortality affect manatee reproduction, distribution, recruitment, and behavior. For example, mortalities from collisions with watercraft increased approximately 640 percent from the mid-1970s to the mid-1990s (USFWS 1999). In addition to direct impacts, secondary effects from boating include such stresses as disruption of normal breeding behavior, disruption of cow-calf bonding, interference with migration routes and patterns, and the loss of feeding areas. Overall, human-related activities have accounted for about 50 percent of all manatee deaths in Florida during the last 25 years (USFWS 1999).

New Threats: Brevetoxins from periodic blooms of dinoflagellates (*Gymnodinium brevii*), commonly referred to as red tide, have been associated with recent manatee die-offs. Future outbreaks could be detrimental to the species if not controlled, but the cause of red tide is currently unknown. Other threats include natural catastrophic events such as low temperatures and hurricanes. However, collisions with watercraft, harassment by divers, boaters, and fisherman, and loss or degradation of seagrass beds remain the most serious threats to the manatee (USFWS 1999).

In Puerto Rico, the primary cause of manatee mortality seems to be from entanglement in gill nets. Collisions with boats and illegal killing of manatees for food may also be affecting the Puerto Rican population to some extent, but supporting data are limited.

Sea Turtles

Both Species

Reason for Listing: There are many threats to sea turtles, including nest destruction by natural events, such as tidal surges and hurricanes, or eggs lost to predation by raccoons, ghost-crabs, and other animals. However, human activity has significantly contributed to the decline of sea turtle populations along the Atlantic Coast and in the Gulf of Mexico (NRC, 1990). These factors include the modification, degradation, or loss of nesting habitat by coastal development, artificial lighting, beach driving, and marine pollution and debris. Furthermore, the overharvest of eggs for food, intentional killing of adults and

immature turtles for their shells and skin, and accidental drowning in commercial fishing gear are primarily responsible for the worldwide decline in sea turtle populations.

Range-wide Trend:

Loggerhead Sea Turtle

Total estimated loggerhead nesting in the southeastern U.S. is approximately 50,000 to 70,000 nests per year (NMFS and USFWS, 1991b). In 1998, there were over 80,000 nests in Florida alone. From a global perspective, the southeastern U.S. nesting aggregation is of paramount importance to the survival of the species and is second in size only to that which nests on islands in the Arabian Sea off Oman (Ross, 1982; Ehrhart, 1989; NMFS and USFWS, 1991b). The status of the Oman colony has not been evaluated recently, but its location in a part of the world that is vulnerable to disruptive events (e.g., political upheavals, wars, catastrophic oil spills) is cause for considerable concern (Meylan et al., 1995). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia account for about 88 percent of nesting worldwide (NMFS and USFWS, 1991b). About 80 percent of loggerhead nesting in the southeastern U.S. occurs in six Florida counties (Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties) (NMFS and USFWS, 1991b).

Genetic research (mtDNA) has identified four loggerhead nesting subpopulations in the western North Atlantic: (1) the Northern Subpopulation occurring from North Carolina to around Cape Canaveral, Florida (about 29° N); (2) South Florida Subpopulation occurring from about 29° N on Florida's east coast to Sarasota on Florida's west coast; (3) Northwest Florida Subpopulation occurring at Eglin Air Force Base and the beaches near Panama City; and (4) Yucatán Subpopulation occurring on the eastern Yucatán Peninsula, Mexico (Bowen et al., 1993; B.W. Bowen, University of Florida, Gainesville, in litt., November 17, 1994, and October 26, 1995; Encalada et al., 1998). These data indicate that gene flow between these four regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to replenish the depleted nesting population. The Northern Subpopulation has declined substantially since the mid-1970s but may have stabilized in recent years. The South Florida Subpopulation has shown significant increases over the last 25 years, indicating the population is recovering, although a trend could not be detected during the first 7 years (1989-1995) of the State of Florida's Index Nesting Beach Survey program. Nesting surveys in the Northwest Florida and Yucatán Subpopulations has been too irregular to date to allow for a meaningful trend analysis (Turtle Expert Working Group, 1998).

Threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; disease; and incidental take from channel dredging and commercial trawling, longline, and gill net fisheries. There is particular concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by longline fishing vessels from several countries.

Green Sea Turtle

About 200 to 1,100 females are estimated to nest on beaches in the continental U.S. In the U.S. Pacific, over 90 percent of nesting throughout the Hawaiian archipelago occurs at the French Frigate Shoals,

where about 200 to 700 females nest each year. Elsewhere in the U.S. Pacific, nesting takes place at scattered locations in the Commonwealth of the Northern Marianas, Guam, and American Samoa. In the western Pacific, the largest green turtle nesting aggregation in the world occurs on Raine Island, Australia, where thousands of females nest nightly in an average nesting season. In the Indian Ocean, major nesting beaches occur in Oman where 6,000 to 20,000 females are reported to nest annually.

Total population estimates for the green turtle are unavailable, and trends based on nesting data are difficult to assess because of large annual fluctuations in numbers of nesting females. For instance, in Florida, where the majority of green turtle nesting in the southeastern U.S. occurs, estimates range from 200 to 1,100 females nesting. Populations in Surinam, and Tortuguero, Costa Rica, may be stable, but there is insufficient data for other areas to confirm a trend.

A major factor contributing to the green turtle's decline worldwide is commercial harvest for eggs and food. Fibropapillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously impacted green turtle populations in Florida, Hawaii, and other parts of the world. The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens become severely debilitated and die. Other threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations.

Both Species

New Threats: The most serious threats to the loggerhead and green sea turtles' continued existence are incidental take from channel dredging and commercial trawling, longline, and gill net fisheries; the loss and degradation of nesting habitat from continued and future coastal development and beach stabilization; sediment disposal on beaches and beach grooming; disorientation of hatchlings by beachfront lighting; increased recreational activities on the beach (e.g., off-road vehicles); excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and disease. There is particular concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by longline fishing vessels from several countries.

Another major factor contributing to the green sea turtle's decline worldwide is commercial harvest for eggs and food. Fibropapillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously impacted green sea turtle populations in Florida, Hawaii, and other parts of the world. The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens become severely debilitated and die.

Piping Plover

Reasons for Listing: Hunting during the 19th and early 20th centuries likely led to initial declines in the species; however, shooting piping plovers has been prohibited since the 1918 pursuant to the provisions of the Migratory Bird Treaty Act. Other human activities, such as habitat loss and degradation, disturbance from recreational pressure, contaminants, and predation are likely responsible for continued declines.

These factors include development and shoreline stabilization

Range-wide Trend: Two range-wide population surveys have been conducted for the piping plover; the 1991 (Haig and Plissner, 1992) and 1996 International Piping Plover Censuses (Plissner and Haig, 1997). These surveys were completed to help determine the species distribution and to monitor progress toward recovery.

Great Lakes Population

The Great Lakes plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada. Russell (1983) reviewed historical records to estimate the pre-settlement populations of the plover throughout this range. While estimates may be high for some Great Lakes states, no other historic estimates are available. Total population estimates ranged from 492 to 682 breeding pairs in the Great Lakes region; Michigan alone may have had the most with as many as 215 pairs.

The endangered Great Lakes population is at a perilously low level. From an all-time low of 12 nesting pairs in 1990, the population has increased to 32 nesting pairs in 1999, then declined again to 30 pairs in 2000, but has not increased significantly since listing. During this period most nesting occurred in Michigan, but in 1998, and again in 1999, one pair nested along the Lake Superior shoreline in Wisconsin.

Reproduction is adversely affected by human disturbance of nesting areas and predation by foxes, gulls, crows and other predators. Shoreline development, such as the construction of marinas and breakwaters, has adversely affected nesting and brood rearing in this population. As with other populations, unleashed dogs and feral cats may harass and kill the birds.

Atlantic Coast Population

The Atlantic Coast piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec, Canada to North Carolina. Piping plovers were common along the Atlantic Coast during much of the 19th century, but nearly disappeared due to excessive hunting for the millinery trade. Following passage of the Migratory Bird Treat Act in 1918, numbers recovered to a 20th century peak which occurred during the 1940's. The current population decline is attributed to increased development and recreational use of beaches since the end of World War II.

The Atlantic Coast piping plover population has increased from 790 pairs since listing to 1,386 pairs in 1999 (USFWS, 2000a). However, it is important to note that the increase is very unevenly distributed, with most pairs occurring in New England, and can be partially attributed to increased survey efforts, especially in the southern half of the species' range (USFWS, 1996a). From 1986 to 1994, the Southern recovery unit increased from 158 to 217 nesting pairs, then declined to 182 pairs in 1999. The recovery objective for the Atlantic Coast population and the Southern recovery unit is 2,000 and 400 breeding pairs, respectively (USFWS, 1996a).

The recovery plan (USFWS, 1996a) cites a population viability analysis (Melvin and Gibbs, 1994) that states:

> "The modeled scenario that most closely approximates the current status of the Atlantic coast piping plover population – 1,200 to 1,500 pair populations with average productivity of 1.25 chicks per pair – showed, respectively, extinction probabilities of 35% and 31% over 100 years, and 95% and 92% probabilities of the population dropping below 500 pairs during the same time period."

Attainment of the subpopulation goal for the Southern recovery unit is particularly important because of its current small size and sparse distribution over large geographic areas (USFWS, 1996a).

A growing body of information shows that overwash-created and -perpetuated habitats, including inlets that are not artificially stabilized, inlets that have recently closed and remain undeveloped, and moist sparsely vegetated barrier flats are especially important to piping plover productivity and carrying capacity (Wilcox, 1959; Cairns, 1982; Strauss, 1990; Burger, 1994; Goldin and Regosin, 1998; Elias et al., 2000). In the Southern recovery unit, productivity and carrying capacity of Atlantic Coast piping plover breeding habitat is especially dependent on the availability of overwashes and naturally functioning inlets. Loegering and Fraser (1995) found that chicks on Assateague Island, Maryland that were able to reach bay beaches and the island interior had significantly higher fledgling rates than those that foraged solely on the ocean beach. Higher foraging rates, percentage of time spent foraging, and abundance of terrestrial arthropods on the bay beach and interior island habitats supported their hypothesis that foraging resources in interior and bayside habitats are key to reproductive rates on that site. Their management recommendations stressed the importance of sparsely vegetated cross-island access routes maintained by overwash, and the need to restrict or mitigate activities that reduce natural disturbance during storms. Dramatic increases in plover productivity and breeding population on Assateague since the 1991-92 advent of large overwash events corroborate Loegering and Fraser's conclusions. Piping plover productivity, which had averaged 0.77 chicks per pair during the five years before the overwash, posted an average of 1.67 chicks per pair in the years 1992 to 1996. The nesting population on the northern 5.0 miles (8.0 km) of the island also grew rapidly, doubling by 1995 and tripling by 1996, when 61 pairs nested there (MacIvor, 1996). Habitat use data continues to show predominant use of interior and bayside habitats (NPS and MDNR, 1993-1997). Furthermore, another 11.8-mile section of Assateague Island, where effects of artificial dunes remained visible until the winter of 1997-98, 25 to 30 years after the National Park Service abandoned dune maintenance, supported only nine plover nests and fledged three chicks over the six years of 1992 to 1997 (MDNR, 1993; NPS and MDNR, 1993-1997). A recently formulated restoration project for northern Assateague Island has a design criterion of allowing approximately one major overwash event per year (Hecht and Moser, 1998).

In Virginia, Watts et al. (undated) found that piping plovers nesting on 13 barrier islands from 1986 to 1988 were not evenly distributed along the islands. Beach segments used by plovers had wider and more heterogenous beaches, fewer stable dunes, greater open access to bayside foraging areas, and in closer proximity to mud flats. They note that characteristics of beaches selected by plovers are maintained by frequent storm disturbance.

The breeding piping plover population in North Carolina dropped to a 12-year low of only 24 pairs in 2000 (D. Allen, NCWRC, in litt.), compared with a post-listing high of 55 pairs in 1990. This is consistent with very poor productivity in North Carolina, averaging 0.49 chicks per pair 1990-1999, compared with 1.33 chicks per pair for the entire United States Atlantic Coast during the same period (USFWS, 2000a), and well below the 1.5 chicks per pair recovery criterion in the Atlantic Coast recovery plan (USFWS, 1996a). Concerns about the declining North Carolina breeding population are heightened by the piping

plover situation in southern Virginia (south of Cedar Island), where the breeding population has plummeted from 29 pairs in 1995 to only 4 pairs in 2000. Overall, the North Carolina breeding population appears to be in a precarious situation.

A consistent finding of all analyses of the demographic factors affecting the persistence and/or extinction of piping plover populations (Ryan et al., 1993; Melvin and Gibbs, 1994; Plissner and Haig, 2000b) is that vulnerability to extinction is greatly increased by even small declines in survival rates. Modeling by Melvin and Gibbs (1994), for example, showed approximately four-fold increases in the likelihood of extinction of the Atlantic Coast piping plover population when survival rates of adults and juveniles declined by as little as 5 and 10 percent, respectively, and other parameters were held constant[1]. Since piping plovers spend 55 to 80 percent of their annual cycle associated with wintering areas, factors that affect their well-being on the wintering grounds will substantially affect their survival and recovery (USFWS, 1996a).

North Great Plains Population

The Northern Great Plains plover breeds from Alberta to Manitoba, Canada and south to Nebraska; although some nesting has recently occurred in Oklahoma. Currently the most westerly breeding piping plovers in the United States occur in Montana and Colorado. According to the last breeding census (Plissner and Haig, 1997), the Northern Great Plains population is the largest of the three breeding populations, numbering approximately 1398 breeding pairs.

The decline the Northern Great Plains population has been attributed to the construction and operations of dams on rivers that result in the loss of sandbar habitat. Reservoirs created by the dams have flooded much of the rivers' natural sandbar habitats, although birds can use shorelines of reservoirs where appropriate substrates exist. However, unless reservoirs are managed to preclude vegetation in some years nesting habitat is minimized. Dam operations for purposes other than plover nesting may cause sandbar/island habitat inundation or flooding of nests. Too much water in the spring floods nests; whereas, dams operated with steady constant flows over a long period of time allows grasses and other vegetation to grow on the prime nesting islands, making these sites unsuitable for successful nesting. Population declines in alkali wetlands are attributed to wetland drainage, contaminants, and predation.

Ryan et al. (1993) developed a stochastic population growth model using empirical, demographic data, and that model indicated that the Great Plains population of the piping plover was declining seven percent annually. Unchecked, that decline would result in extirpation in approximately 80 years. Furthermore, the model showed that as little as a five percent increase in the annual rate of adult mortality would increase the rate of decline in that population by 38 percent. Holding adult and immature survival rates constant, the model also projected fledge rates needed to stabilize the population, including what might happen with delays in initiation of population growth. The model results indicated the Great Plains plover population was undergoing a substantial decline.

[1] Simulations referenced involved population sizes from 1,200 to 2,000 pairs with an average productivity of 1.5 chicks per pair. Probability that the population would drop below 500 pairs also increased substantially, for example, from 55 to 97 percent for a 1,200 pair population. It should be noted that average 1990-1999 productivity on the U.S. Atlantic Coast was only 1.33 chicks per pair.

From 1991 to 1996, the Northern Great Plains (United States and Canada) piping plover numbers declined by five percent. However, when you look at the United States portion of the Northern Great Plains population alone, piping plover numbers declined by 24 percent. This decline closely matches the Ryan et al. (1993) model.

All Populations - Migrating and Wintering

Piping plovers from all three breeding populations primarily winter along the South Atlantic and Gulf Coasts beaches and barrier island from North Carolina to Texas, although some migrate to the Bahamas and West Indies. The highest concentration of birds reported in winter censuses are found in Texas, Louisiana, and Florida. However, only 63 percent of the breeding birds counted in 1991 were reported during the winter census, suggesting that important wintering areas are still unknown throughout this region. Wintering and migrating piping plovers on the Atlantic Coast are generally found at the accreting ends of barrier islands, along sandy peninsulas, and near coastal inlets. Wintering piping plovers appear to prefer sand flats adjacent to inlets or passes, sandy mud flats along prograding spits, and overwash areas as foraging habitats. These substrate types may have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds. Roosting plovers are generally found along inlet and adjacent ocean and estuarine shorelines and their associated berms and on nearby exposed tidal flats (Fussell, 1990; Nicholls and Baldassarre, 1990b). Diverse coastal systems may be especially attractive to plovers and may concentrate wintering piping plovers when roosting and feeding areas are adjacent (Nicholls and Baldassarre, 1990b).

While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods of time relative to wintering or breeding, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle. The possibility of lower survival rates for Atlantic Coast piping plovers breeding at higher latitudes (based on relationships between population trends and productivity) suggest that migration stress may substantially affect survival rates of this species (Anne Hecht, USFWS, pers. comm.). In addition, observations suggest that this species exhibits a high degree of nest site fidelity (Wilcox, 1959; Haig, 1985; Haig and Oring, 1988a).

Migratory and winter residents occur along the North Carolina coast from early August to late May (Potter et al., 1980). Unfortunately, survey efforts to date outside the breeding season have been extremely limited. Three statewide surveys for wintering piping plovers in North Carolina were conducted – January 1987 (Nicholls and Baldassarre, 1990a), January 1991 (Haig and Plissner, 1992), and January 1996 (Plissner and Haig, 1997); statewide counts from these surveys were 50 birds in 1987, 20 birds in 1991, and 50 birds in 1996. While fairly comprehensive in geographic scope, these surveys represent only a single visit to each site. Furthermore, they were designed to capture wintering activity, rather than use by migrating plovers which might be more important to the Atlantic Coast population in North Carolina.

The source population of a piping plover seen outside its breeding range can only be determined if it has been banded. Furthermore, the probability of sighting banded birds from a given breeding population is biased by the size of the breeding population, the proportion of banded birds, and the intensity of survey effort in the wintering/migration areas. While the vast majority of overwintering birds are likely to be from the largely unbanded Atlantic Coast population, individuals from the Great Lakes and Northern Great

Plains populations have been documented in North Carolina. Overwintering birds from the Great Lakes population have been seen on the Outer Banks (south of Oregon Inlet, November 3, 2000, reported by M. Hannisian). It is noteworthy that 24 of 39 confirmed individual plovers from the Great Lakes population sighted on the wintering grounds between fall 1993 and spring 1999 were found on the Atlantic Coast. Piping plovers from the Northern Great Plains population have also been documented in North Carolina. Pooled sightings of banded plovers from the 1991 International Census and earlier reports included 26 piping plovers (14 percent of sightings) from inland breeding populations wintering in North and South Carolina (Haig and Plissner, 1992), while 84 percent of 49 sightings of banded plovers occurred on the southern Atlantic Coast. More recent sightings of plovers banded in Atlantic Canada are consistent with this pattern (e.g., recent sighting of the plover on southern Figure Eight Island on December 29, 2000, and again on January 13, 2001, by D. Carter, Southern Environmental Law Center, pers. comm.; D. Amirault, Canadian Wildlife Service, in litt.).

All Populations

New Threats: Many future threats to this species' continued existence are similar to the current problems, including increased human and pets disturbance, increased recreational pressures, increased development of beaches and shorelines, the construction of beach stabilization structures, and the prevention of overwash-created and -perpetuated habitats.

Barrier beach habitats preferred by both breeding and wintering piping plovers are dynamic, storm-maintained ecosystems, and much of this species' historic habitat along the Atlantic Coast has been destroyed or permanently degraded by development and human use. The construction of houses and commercial buildings on and adjacent to barrier beaches directly removes plover habitat and results in increased human disturbance. The impacts of shoreline development are often greatly expanded by the attendant concerns for protecting access roads. While legal restrictions on coastal development may slow the future pace of physical habitat destruction, the trend in habitat availability for this species is down.

A more subtle threat to the plover is the decrease in the suitability of the species' habitat due to accelerating recreational activity and development along the Atlantic Coast. Habitat loss occurs when suitable nesting sites are made unusable because high human and/or animal use precludes the birds from successfully nesting. Habitat loss can also occur when important wintering habitats are made unusable by increased man-made activities and operations (i.e., sand disposal, inlet dredging, etc.) which cause birds to flee protective habitats and use valuable energy reserves.

Human population growth along the United States coast creates an ever increasing demand for beach recreation. In 1993 only 32 percent of the U. S. Atlantic Coast population of piping plovers nested on Federally-owned beaches where at least some protection can be afforded. The remaining 68 percent of the birds nested on State, Town, or privately-owned beaches where they face increasing disturbance from recreationists and development. The situation in the plover's Atlantic Coast wintering range is similar; 37 percent of the shoreline recently proposed for designation as critical habitat for wintering piping plovers in North Carolina, South Carolina, and Georgia is Federally-owned, while 63 percent is in State and private ownership (65 FR 41782). Pressure from development and human disturbance on Atlantic Coast beach habitat continues, and the recovery plan emphasizes that piping plover habitat protection efforts must recognize and seek to perpetuate the natural dynamism of these barrier systems (USFWS, 1996a).

The Atlantic Coast Piping Plover Recovery Plan (USFWS, 1996a) calls for the protection of all known wintering habitat by preventing habitat degradation and disturbance, including direct and indirect impacts of shoreline stabilization, navigation projects, and development, disturbance by recreationists and their pets, and contamination and degradation due to oil or chemical spills. In addition, the plan addresses the need to identify important migration stop-over habitat and mitigate any factors that may adversely affect these areas. Factors that must be considered include: (1) energetic depletion due to displacement of birds as a result of disturbance, even if alternative habitats are available; and, (2) short- and long-term effects on prey availability that can extend effects on habitat quality long after the completion of a given action.

E. Analysis of the Species/Critical Habitat likely to be Affected

Barrier islands and inlets are complex and dynamic coastal systems that are continually responding to sediment supply, waves, and fluctuations in sea level. The location and shape of the beaches of barrier islands perpetually adjusts to these physical forces. Waves that strike a barrier island at an angle, for instance, generate a longshore current that carries sediment along the shoreline. Cross-shore currents carry sediment perpendicular to the shoreline. Wind moves sediment across the dry beach, dunes and island interior. During storm events, overwash may breach the island at dune gaps or other weak spots, depositing sediments on the interior and back sides of islands, increasing island elevation and accreting the soundside shoreline.

Tidal inlets play a vital role in the dynamics and processes of barrier islands. Sediment is transferred across inlets from island to island via the tidal shoals or deltas. The longshore sediment transport often causes barrier spits to accrete, shifting inlets towards the neighboring island. Flood tidal shoals that are left behind by the migrating inlet are typically incorporated into the soundside shoreline and marshes of the island, widening it considerably. Many inlets have a cycle of inlet migration, breaching of the barrier spit during a storm, and closure of the old inlet with the new breach becoming the new inlet. Barrier spits tend to be low in elevation, sparse in vegetation, and repeatedly submerged by high and storm tides.

Seabeach Amaranth

The proposed action has the potential to adversely affect seabeach amaranth within the proposed project area. The effects of the proposed action on seabeach amaranth will be considered further in the remaining sections of this opinion. Potential effects include burying, trampling, or injuring plants as a result of construction operations and/or sediment disposal activities; burying seeds to a depth that would prevent future germination as a result of construction operations and/or sediment disposal activities; and, destruction of plants by trampling or breaking as a result of increased recreational activities.

West Indian Manatee

The proposed action has the potential to adversely affect West Indian manatees within the proposed project area. The effects of the proposed action on West Indian manatees will be considered further in the remaining sections of this opinion. Potential effects include the injuring or killing of manatees resulting from collisions with boats as a result of dredging operations.

Sea Turtles

The proposed action has the potential to adversely affect nesting females, nests, and hatchling loggerhead and green sea turtles within the proposed project area. The effects of the proposed action on sea turtles will be considered further in the remaining sections of this opinion. Potential effects include destruction of nests deposited within the boundaries of the proposed project; harassment in the form of disturbing or interfering with females attempting to nest within the construction area or on adjacent beaches as a result of construction activities; disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; and, behavior modification of nesting females due to escarpment formation within the project area during a nesting season resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs. The quality of the placed sand could affect the ability of female turtles to nest, the suitability of the nest incubation environment, and the ability of hatchlings to emerge from the nest.

Piping Plover

The proposed action has the potential to adversely affect nesting piping plovers, nests, hatchlings, and overwintering and migrating plovers within the proposed project area. The effects of the proposed action on piping plovers will be considered further in the remaining sections of this opinion. Potential effects include the destruction of nests created within the boundaries of the proposed project; harassment in the form of disturbing or interfering with plovers attempting to nest, forage, or roost within the construction area or on adjacent beaches as a result of construction activities; harassment in the form of disturbing or interfering with plovers attempting to nest, forage, or roost within the construction area or on adjacent beaches as a result of increased pedestrian or animal traffic; killing of fledgling birds as they begin to leave the nest; behavior modification of nesting plovers due to disturbances associated with construction activities within the project area resulting in failed nest attempts or situations in which they choose marginal or unsuitable nesting areas; and, behavior modification of migrating or wintering plovers due to disturbances created by the construction activities within the project area resulting in excessive energy expenditures or displacement of birds to unsuitable sites, increased foraging behavior, or situations where they choose marginal or unsuitable resting or foraging areas. The construction activities could also lead to diminished quantity and quality of intertidal foraging habitats within the action area, compared with flood tidal deltas at naturally functioning and migrating inlets resulting in decreased survivorship of nesting, migrating or overwintering plovers.

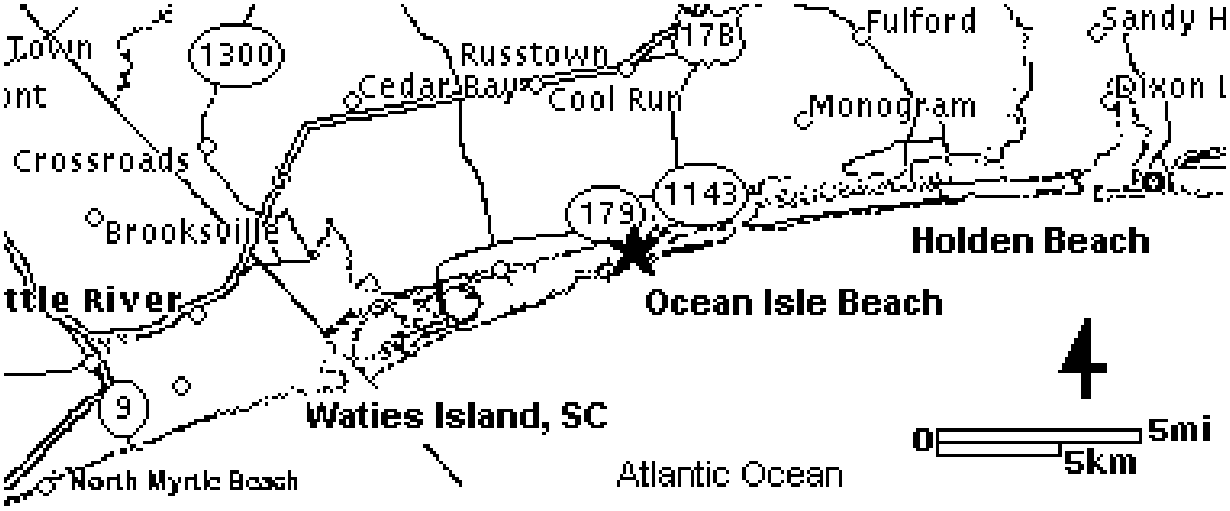
III. Environmental Baseline

A. Action Area

1. Location

The Ocean Isle Beach Project area includes Ocean Isle Beach from approximately Station 9+50 westward to Station 181+00 (approximately 3.25 miles, 5.2 km); from 40 ft (12 m) inland from the natural vegetation line at elevation 7 ft (2.1 m) NGVD to nearshore waters -26 ft (-7.9 m) NGVD; and Shallotte Inlet at -15 ft (-4.6 m) NGVD from the AIWW to the bar channel (approximately 4,800,000 square ft or 110 acres, 44.5 ha). The project area includes approximately 85,800,000 square ft (approximately 1,970 acres, 798 ha) of oceanfront shoreline and approximately 4,800,000 square ft (approximately 110 acres, 44.5 ha) of inlet and nearshore waters.

The action area for direct impacts includes those sections of Ocean Isle Beach and Shallotte Inlet where dredging, sediment disposal, and earthen manipulation will occur. The action area for indirect impacts, however, is much larger. Because manatees, sea turtles, and piping plovers are highly mobile species, animals influenced by direct project impacts may move great distances from the actual project site. For example, a piping plover that cannot nest on the sand spits around Shallotte Inlet due to the dredging of the inlet channel may fly many miles only to find marginal nesting sites. Nest site fidelity may influence the nesting success of the plover pair in successive years and may reduce the future nesting success of their offspring. Likewise, sea turtles exhibit nest site fidelity; therefore, habitat destruction may cause females to choose marginally suitable habitat resulting in lower reproductive success, as well as long term decreased reproduction by the surviving hatchlings. Further, migrating and wintering plovers that cannot forage on the sand spits within the project area during the construction operation may expend energy to find other suitable feeding sites. The excessive energy expenditure may result in the bird's decreased ability to migrate back to its breeding grounds and successfully reproduce. The range of these movements produced by the project constitute the action area for indirect impacts; for the purposes of this opinion it will be the entire islands of Holden Beach, Ocean Isle Beach, and Sunset Beach and their corresponding inlets – Shallotte and Tubbs – of those beaches that may be used by manatees, sea turtles



and piping plovers. The action area for seabeach amaranth is the area within the proposed project footprint.

2. Land Ownership/Access

Land ownership within the action area is both public and private, and land use encompasses recreational, commercial and residential activities. The State of North Carolina, the Towns of Holden Beach, Ocean Isle Beach, and Sunset Beach, and many private individuals own and/or manage properties within the project area. All oceanfront beach property above the high tide line on Holden Beach, Ocean Isle Beach, and Sunset Beach is privately owned by various individuals and businesses. For all beaches, all property below the mean high tide line is publicly owned, and the dry sand beach area between mean high water and the primary dune line is subject to public trust rights established by common law and State law.

The action area can be accessed by vehicle, on foot, or by boat. None of the beaches within the action area are open to off-road vehicle traffic.

3. Post-dredging Disposal and Residential and Commercial Development

Ocean Isle Beach, Holden Beach and Sunset Beach contain heavy residential and commercial development. Beach shoreline and inlet stabilization efforts within the action area have had profound effects on residential and commercial development and the occurrence of seabeach amaranth, the nesting habitats of sea turtles, and the nesting, resting and foraging habitats of piping plovers.

From 1990 to 1999, Ocean Isle Beach experienced a 45 percent increase in their permanent population (North Carolina Municipal Population 1990-1999, Office of State Budget, Planning and Management, State of North Carolina). Holden Beach experienced similar permanent population increases (43 percent). Sunset Beach, however, has experienced enormous growth, from 311 to 1,963 (531 percent increase) permanent residents in the last decade. Holden Beach, Ocean Isle Beach, and Sunset Beach are the 72nd, 67th, and 5th, respectively, fastest growing municipalities in North Carolina. Unfortunately, many homes are reported as non-permanent residences; therefore, the actual population growth is deflated.

B. Status of the Species within the Action Area

Seabeach Amaranth

The EA (June 1997) states:

> "A beach survey for seabeach amaranth was conducted by personnel from the Wilmington District in the vicinity of Shallotte Inlet from 1992 through 1995. Total plants counted in 1992 and 1993 were 5 and 15, respectively. Total plants counted in the vicinity of Shallotte Inlet in 1994 and 1995 were 112 and 22, respectively."

The following table represents the numbers of plants found within the project area between 1987 and 1995 (Weakley and Bucher, 1992; COE, 1993). Data for Ocean Isle Beach is from different sources and is, therefore, not completely comparable between years. Data from 1987 - 1990 is from Weakley and Bucher (1992), while data from 1992 -1995 is from the Corps (COE, 1993; COE 1997). Since it is nearly impossible to determine the exact extent of the surveys and, additionally, sand disposal and erosion and inlet migration might have changed the actual length of the inlet reaches, it is very hard to compare data between years. In general, it appears that each survey included both the east and west ends of the islands and did not include the central portions of the islands, where it is believed that little habitat exists. Accordingly, the number of plants reported for each year are likely fewer than what might have occurred in the action area of the proposed project. In general, there appears to be an unstable population of seabeach amaranth on Ocean Isle Beach and throughout the project action area.

	1987	1988	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000
Holden Beach	560	2656	434	21	52	--	--	99	1	32	268	10

Ocean Isle Beach	52	191	12	5	15	112	22	819	7	11	5	4
Sunset Beach	176	232	7	--	--	--	--	--	--	--	--	--

-- data not available

West Indian Manatee

The manatee is generally considered a regular, but infrequent, resident of North Carolina's coastal waters. Since first reported in 1919, the manatee has been documented from at least 60 sites in 13 coastal counties in North Carolina. The majority (48 of 57) of these sightings were reported during the warm water summer months of June through October (Schwartz, 1995). An equal number of these sightings were reported from creeks, inlets, sounds, and the open ocean. At least 10 sightings of manatees have been documented within the freshwater, brackish, and saltwater environments of Brunswick County, North Carolina and Horry County, South Carolina (Rathbun et al., 1982; Schwartz, 1995). However, the only known sighting in the vicinity of Ocean Isle Beach was reported in July, 1976 (Schwartz, 1995).

Sea Turtles

Loggerhead sea turtles represent greater than 98 percent of all sea turtle nesting activity in North Carolina (NCWRC, 1998), and most nesting activity occurs between mid-May and late August (Palmer and Braswell, 1995), but may occur into September. The loggerhead sea turtle nesting and hatching season for North Carolina extends from May 1 through November 15. Incubation for the loggerhead sea turtle ranges from about 45 to 90 days.

Green sea turtles nest sporadically in North Carolina (NCWRC, 1998). However, in recent years, nesting activity by this species has been on the rise. In the 20-year period from 1980 through 1999, a total of 74 green sea turtle nests were recorded from 13 areas of North Carolina and approximately 22 nests were recorded during 2000. The green sea turtle nesting and hatching season for North Carolina extends from May 15 through November 15. Incubation ranges from about 45 to 75 days.

The EA (June 1997) states:

> "Data collected by the North Carolina Wildlife Resources Commission (NCWRC) indicates that loggerhead sea turtles are nesting on Ocean Isle Beach. In 1992, 20 nests were counted, and in 1993, 8 nests were counted. In August of 1994, 19 nests were reported... ...Green sea turtles are also known to nest sporadically along the North Carolina coast. However, to date, too few green sea turtle nests have been discovered in the State to allow meaningful analysis of nesting trends or success."

The following table represents the number of known loggerhead sea turtle nests as recorded by the Commission in the action area of the proposed project from 1991 to 2000.

	1991	1992	1993	1994	1995	1996	1997	1998*	1999	2000*

Holden Beach	42	54	43	35	39	45	21	73**	53	32
Ocean Isle Beach	n/a	80	8	54	14	39	19	34	34	21
Sunset Beach	25	7	8	19	5	12	4	17	3	20

"*" Indicates preliminary numbers subject to change
"**" Includes two green sea turtle nests

Piping Plover

North Carolina occupies a critical geographic link in the life cycle of the piping plover. It is the only State in the species' range to receive use by both breeding and wintering plovers. Wintering activity has been documented in North Carolina for plovers from all three breeding populations (Haig and Plissner, 1992). Equally significant is North Carolina's location on the Atlantic Coast migration route; it is likely that a very high proportion of the Atlantic Coast population depends on North Carolina stopover habitat during the annual spring and fall migrations.

The EA (June 1997) states:

> "Piping plovers prefer upper edges of overwash areas at inlets or large open unvegetated beaches for nesting. The highly developed nature of the beaches within the study area, however, very likely excludes the area as prime piping plover nesting habitat. There has been no recorded nesting by piping plovers along the ocean beach within the project area."

While the preponderance of piping plovers breeding in North Carolina over the last twelve years have been north of Cape Lookout, successful breeding has occurred in the vicinity of the action area. Four pairs nesting at Holden Beach in 1993 fledged one chick per pair (J. [Nicholls] Allen, North Carolina Coastal Land Trust, in litt.). However, nesting on Ocean Isle Beach and Sunset Beach has not been well documented. Breeding pairs were also documented sporadically at Waties Island, South Carolina in the early 1990s (Murray and McDavit, 1993) with as many as five birds seen.

The Commission collected data on the presence of breeding plovers in the project area; however, surveys were not conducted every year and never exceeded three monitoring days per year. The following table represents the number of known breeding plover pairs within the action area for most years between 1989 to 2000.

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
West Holden Beach	2(1)	2(1)	2(1)	4(1)	4(1)	1(1)	1(1)	0.5(1)	1(1)	1(1)	0(1)	0(1)
Ocean Isle Beach	0(1)	--	0.5(1)	--	0(1)	0(1)	--	0(1)	0(1)	1(1)	0(1)	0(1)
Sunset Beach/ Bird Island	0(1)	--	0(1)	--	0(1)	3(3)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)

"--" indicates no survey conducted
"(1)" indicates number of monitoring days during the season

The Commission also collected data on the presence of wintering plovers in the project area. Again, surveys were not conducted every year and never exceeded three monitoring days per year. Furthermore, weather and tidal conditions may influence both the abundance and detectability of wintering piping plovers, so actual piping plover use may be substantially higher than indicated by these limited survey data.

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
West Holden Beach	--	4(1)	2	--	--	--	--	0(1)	3	--	--	7
Ocean Isle Beach	--	0(1)	0	--	--	--	--	0(1)	--	--	--	--
Sunset Beach/ Bird Island	0	1(1)	2(1)	--	--	--	--	2(1)	1	--	--	--

"--" indicates no survey conducted
"1" indicates number of days of monitoring during the season

As noted in the Status of the Species section above, non-breeding (migrating and wintering) plovers are generally found near coastal inlets, and Commission biologists report (D. Allen, NCWRC, in litt.) that all plover observations from the project area have been near the inlets or on the intertidal flats. However, the data reported here illustrates the lack of surveys to draw definitive conclusions.

Available data provide a limited basis for assessing the importance of the action area for migrating plovers, since most surveys have been conducted in the winter. For example, a similar number of plovers were counted on both South Core Banks (5) and the western end of Holden Beach (7) during the winter of 2000. On North Core Banks, however, several single day counts during migration in August and September of 1992 and 1993 tallied 110 to 136 piping plovers, making this one of the most important known staging areas for Atlantic Coast piping plovers (Collazo et al, 1995). More intensive surveys may determine that there are other North Carolina migration stop-over or overwintering areas of similar importance.

C. Factors Affecting Species Environment within the Action Area.

A wide range of recent and on-going beach disturbance activities have altered the proposed action area and, to a greater extent, the North Carolina coastline, and many more are proposed for the immediate future. Nourishment activities widen beaches, change their sedimentology and stratigraphy, alter coastal processes and often plug dune gaps and remove overwash areas. Inlet dredging activities alter the sediment dynamics on adjacent shorelines and stabilize these dynamic environments; beach disposal of dredge material further alters the natural habitat adjacent to inlets. Beach scraping, which has increased in frequency in recent years, can artificially steepen beaches, stabilize dune scarps, plug dune gaps, and redistribute sediment distribution patterns. Artificial dune building, often a product of beach scraping, removes low-lying overwash areas and dune gaps. As chronic erosion catches up to structures throughout the action area, artificial dune systems are constructed and maintained to protect beachfront structures either by sand fencing or fill placement. Inlet stabilization projects, such as jetties and groins, reduce the dynamism of overwash areas adjacent to inlets. Estuarine dredging of navigational channels can alter water circulation patterns and sediment transport pathways, as well as increase the frequency

and magnitude of boat wakes; sound-side sand or mud flats may be impacted by increased erosion rates as a result. Excessive recreational use of beaches and flats may also pose a threat to the species utilizing these habitats by making them unsuitable or dangerous. All of these actions may have adverse effects on seabeach amaranth, manatees, nesting sea turtles and their offspring, and breeding and non-breeding piping plovers by destroying, diminishing, or altering the habitats on which they depend.

IV. Effects of the Action

A. Factors to be Considered

Proximity of the action: The proposed project is in the immediate vicinity of habitats important for seabeach amaranth, manatees, nesting sea turtles, and nesting, foraging, and roosting piping plovers. Specifically, the proposed project will potentially impact one of the largest remaining seabeach amaranth populations (plants and seed source), summer transient manatees, loggerhead sea turtles from the Northern subpopulation, and Atlantic Coast breeding plovers from the Southern Recovery Unit, as well as non-breeding plovers from the Great Lakes, Atlantic Coast, and Northern Great Plains populations. In addition, the proposed action has the potential to directly impact as much as 5.9 miles (9.5 km) of shoreline and sand and mud flats that have been proposed for designation as critical habitat for overwintering piping plovers.

Distribution: Disturbance activities that will impact listed species will primarily occur on the ocean front shoreline of Ocean Isle Beach and in the waters of Shallotte Inlet. Mobile species, such as the manatee, sea turtles, and the piping plover, may also be affected in nearby waterways and on adjacent islands by intraspecific competition, excessive energy expenditure, and marginally suitable habitat selection. The longshore transport may redistribute eroded sand to portions of beaches (i.e., Holden Beach and Sunset Beach) beyond the project construction area which might affect seabeach amaranth plants on those beaches.

Timing: The timing of the proposed project will result in direct impacts occurring during the growing season for seabeach amaranth, during the nesting season for sea turtles and the piping plover, and during the migratory period of piping plovers. Transient manatees may also be affected by the timing of the proposed project. The effects of the project impacts are likely to remain or continue through the migratory and wintering periods for the piping plover, as well as subsequent nesting years for sea turtles and the piping plover and growing seasons for seabeach amaranth.

Nature of the Effect: The effects of the action are likely to destroy, alter, or diminish the nesting success of sea turtles and the piping plover. The effects are also likely to adversely impact foraging and resting habitats of migrating and wintering piping plovers, which may decrease their survival rates. Any reduction in productivity and/or survival rate will contribute to a vulnerability to extinction in sea turtles and the piping plover. The effects of the proposed action could harm, harass, or kill manatees if the animals are struck by dredging equipment. The effects of the proposed action could destroy existing seabeach amaranth plants and/or bury plants or seeds, but are also likely to redistribute buried seeds.

Duration: The duration of the direct impacts resulting from construction operations could be short-term, lasting about four to six months, and three months for maintenance dredge and sediment disposal operations. Maintenance events are scheduled to occur every three years, the results of which can

devastate the productivity of sea turtles and piping plover that rely on habitats within the project area. The continuous impacts could also destroy the local population of seabeach amaranth through repeated disposal on the project beach. The duration of the indirect impacts could vary in intensity in subsequent years and last the life of the project or beyond. The duration of the direct impacts resulting from the proposed action is not likely to adversely affect the manatee unless conducted during the summer months.

Disturbance Frequency: Productivity of the North Carolina, Southern Recovery Unit, and United States Atlantic Coast piping plover is below that identified in the Atlantic Coast recovery plan. As discussed in the Status of the Species Section, with low numbers and reduced productivity, the probability of extinction increases. Continuous impacts to habitats important for this species will likely result in the species being unable to recover between disturbances. At the very least, the plover will become more sensitive to the effects of other disturbances. Further, the disturbance frequency of dredging and sediment disposal might also adversely affect productivity of plovers from the Great Lakes, Northern Great Plains, and Atlantic Canada populations while migrating through or overwintering within the project area. The Northern subpopulation of loggerhead sea turtles could experience reduced nesting success with repeated disturbances resulting from the disposal of dredged sediments. While it appears that the number of nesting loggerheads is nearing the objective of the recovery plan, the time it takes for turtles to reach sexual maturity could cloak the availability of future sexually mature females and, thus, nesting success. Repeated disturbance to seabeach amaranth could result in extirpation of the plant from the project beaches. The duration of the direct impacts resulting from subsequent dredging events are not likely to adversely affect the manatee unless conducted during the summer months.

Disturbance Intensity and Severity: The effects of disturbance from the proposed project on the Southern Recovery Unit and the North Carolina breeding population of the Atlantic Coast piping plover could result in the reduction of the breeding population by 3 percent (5 pairs/182 pairs) and 21 percent (5 pairs/24 pairs), respectively. While this would not be a significant reduction of the overall population, there is concern that impacts that reduce the dispersal area of the Atlantic Coast population would result in a greater intensity of the overall effects of environmental stochasticity, catatrophes, or inconsistent management. The effects of disturbance on the migrating and wintering population of plovers in North Carolina are much greater, however. The effects of the proposed project could result in the significant reduction of the total Great Lakes population, which could lead to extinction. Similarly, if nesting loggerhead females are extirpated from the Northern subpopulation, regional dispersal from other subpopulations will not be sufficient to replenish the depleted nesting subpopulation. Currently, no level of take is allowed for the manatee, and any impact to this species could be detrimental to its survival.

B. Analyses for Effects of the Action

Seabeach Amaranth

Beneficial Effects: The dredging of the inlet channel and the disposal of dredged, beach-compatible sand may benefit this species by providing additional suitable habitat or by redistributing seed sources buried during past storm events, beach disposal activities, or natural barrier island migration. Disposal of dredged sand may be compatible with seabeach amaranth provided the timing of beach disposal is appropriate, the material placed on the beach is compatible with the natural sand, and special precautions are adopted to protect existing seabeach amaranth plants. Further studies are needed to determine the best methods of beach disposal in seabeach amaranth habitat (Weakley and Bucher, 1992).

Direct Effects: Beach disposal activities may bury or destroy existing plants, resulting in mortality, or bury seeds to a depth that would prevent future germination, resulting in reduced plant populations. Increased traffic from recreationists and their pets can also destroy existing plants by trampling or breaking the plants.

Indirect Effects: Future tilling of the beach may be necessary if beach compaction hinders sea turtle nesting activities. Thus, the placement of heavy machinery or associated tilling equipment on the beach may destroy or bury existing plants. Sediments disposed of on the oceanfront beach may, through the longshore transport system, move into the surrounding inlet channels. This could result in the need for additional inlet dredging or sediment disposal activities that would damage or bury plants or seeds.

West Indian Manatee

Beneficial Effects: The Service is not aware of any beneficial effects of the action within the project area for manatees.

Direct Effects: Boats and equipment associated with dredge and disposal activities may result in harm, harassment, or mortality of transient manatees moving through the waterways during the summer months (June through October).

Indirect Effects: Dredge and sediment disposal activities may force manatees to occupy areas that are utilized by boating recreationists. By restricting the free movement of manatees, pleasure boat strikes may increase.

Sea Turtles

Beneficial Effects: The placement of dredged sediments on a beach with reduced dry fore-dune habitat may increase sea turtle nesting habitat if the material is highly compatible (i.e., grain size, color, shape, etc.) with naturally occurring sediments. In addition, properly engineered and constructed beaches may be more stable and may reduce the occurrence of escarpments and sand compaction which could hinder sea turtle nesting activities.

Direct Effects: The placement of sediments on beaches within the project area, in and of itself, may not provide suitable nesting habitat for sea turtles. Although the sand placement may increase the potential nesting area, significant negative impacts to sea turtles may result if protective measures are not incorporated during construction. Sand disposal operations conducted during the nesting and hatching season may result in the burial or crushing of nests or hatchlings or loss of sea turtles through disruption of nesting activity. While a nest monitoring and/or egg relocation program would likely reduce these impacts, nests may be inadvertently missed or misidentified as false crawls during daily patrols. In addition, nests may be destroyed by operations at night prior to beach patrols being performed. Under the best of conditions, approximately 7 percent of nests are misidentified as false crawls by experienced sea turtle nest surveyors (Schroeder, 1994), thus these nests would be destroyed by the project.

Besides the potential for missing nests during a nest relocation program, there is the potential for eggs to be destroyed by their excavation and movement during relocation or for unknown biological mechanisms to be affected. Nest relocation can have adverse impacts on incubation temperature (and hence sex

ratios), gas exchange parameters, hydric environment of nests, hatching success, and hatchling emergence (Limpus et al., 1979; Ackerman, 1980; Parmenter, 1980; Spotila et al., 1983; McGehee, 1990). Relocating nests into sands deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. Water availability is known to influence the incubation environment of the embryos and hatchlings of turtles with flexible-shelled eggs, which has been shown to affect nitrogen excretion (Packard et al., 1984), mobilization of calcium (Packard and Packard, 1986), mobilization of yolk nutrients (Packard et al., 1985), hatchling size (Packard et al., 1981; McGehee, 1990), energy reserves in the yolk at hatching (Packard et al., 1988), and locomotory ability of hatchlings (Miller et al., 1987).

Comparisons of hatching success between relocated and *in situ* nests have noted significant variation ranging from a 21 percent decrease to a 9 percent increase for relocated nests (Florida Department of Environmental Protection, unpubl. data). Comparisons of emergence success between relocated and *in situ* nests have also noted significant variation ranging from a 23 percent decrease to a 5 percent increase for relocated nests (Florida Department of Environmental Protection, unpubl. data). A 1994 Florida Department of Environmental Protection study of hatching and emergence success of *in situ* and relocated nests at seven sites in Florida found that hatching success was lower for relocated nests in five of seven cases with an average decrease for all seven sites of 5.01 percent (range = 7.19 percent increase to 16.31 percent decrease). Emergence success was lower for relocated nests in all seven cases by an average of 11.67 percent (range = 3.6 to 23.36 percent) (A. Meylan, Florida Department of Environmental Protection, in litt.).

A final concern about nest relocation is that the program may concentrate eggs in an area resulting in a greater susceptibility to catastrophic events (e.g., a low area subject to flooding). Hatchlings released from concentrated, relocated nests also may be subject to greater predation rates from both land and marine predators as a result of predators learning where to concentrate their efforts (Glenn, 1998; Wyneken et al., 1998).

The placement of pipelines and the use of heavy machinery on the beach during a construction project may also have adverse effects on sea turtles. They can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls and unnecessary energy expenditures.

Another impact to sea turtles is disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchlings from artificial lighting. Visual cues are the primary sea-finding mechanism for hatchlings (Mrosovsky and Carr, 1967; Mrosovsky and Shettleworth, 1968; Dickerson and Nelson, 1989; Witherington and Bjorndal, 1991). Artificial beachfront lighting is a well documented cause of hatchling disorientation and misorientation on nesting beaches (Philbosian, 1976; Mann, 1977; Florida Department of Environmental Protection, unpubl. data). In addition, research has also documented significant reduction in sea turtle nesting activity on beaches illuminated with artificial lights (Witherington, 1992). Therefore, construction lights along a project beach and on the dredging vessel may deter females from coming ashore to nest, disorient females trying to return to the surf after a nesting event, and disorient and misorient emergent hatchlings from adjacent non-project beaches. Any source of bright lighting can profoundly affect the orientation of hatchlings, both during the crawl from the beach to the ocean and once they begin swimming offshore. Hatchlings attracted to light sources on dredging barges may not only suffer from interference in migration, but may also experience higher probabilities of predation to

predatory fishes that are also attracted to the barge lights. This impact could be reduced by using the minimum amount of light necessary (may require shielding) or low pressure sodium lighting during project construction.

Indirect Effects: Many of the direct effects of beach disposal may persist over time and become indirect impacts. These indirect effects include future sand migration, changes in the physical characteristics of the beach, the formation of escarpments, and the consequences of increased beachfront development.

Future sand displacement on nesting beaches is a potential effect of the proposed beach disposal. The dredging of the existing inlet to an artificially maintained channel will serve as a sand sink and alter the existing movement of sand in the longshore transport system. Over the years of project life, project area beaches may experience excessive recession as a result of artificially maintaining an inlet channel. Such recession would reduce suitable sea turtle nesting habitat.

If the material placed on the beach is dissimilar from the original beach sand, sediment disposal may result in changes in sand density (compaction), beach shear resistance (hardness), beach moisture content, and beach slope (Nelson and Dickerson, 1988a). Physical characteristics of the sand such as color, grain size, grain shape, and grain mineral content may also be changed. These changes could result in adverse impacts on nest site selection, digging behavior, clutch viability, and emergence by hatchlings (Nelson and Dickerson, 1987; Nelson, 1988).

Beach compaction and unnatural beach profiles that may result from beach disposal activity could negatively impact sea turtles regardless of the timing of projects. Very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (Nelson et al., 1987; Nelson and Dickerson, 1988a). Significant reductions in nesting success (i.e., false crawls occurred more frequently) have been documented on severely compacted nourished beaches (Fletemeyer, 1980; Raymond, 1984; Nelson and Dickerson, 1987; Nelson et al., 1987), and increased false crawls may result in increased physiological stress to nesting females. Sand compaction may increase the length of time required for female sea turtles to excavate nests and also cause increased physiological stress to the animals (Nelson and Dickerson, 1988c). Nelson and Dickerson (1988b) concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more.

These impacts can be minimized by using suitable sand and by tilling the beach after nourishment if the sand becomes compacted. The level of compaction of a beach can be assessed by measuring sand compaction using a cone penetrometer (Nelson, 1987). Tilling of a nourished beach may reduce the sand compaction to levels comparable to unnourished beaches. However, a pilot study by Nelson and Dickerson (1988c) showed that a tilled nourished beach will remain uncompacted for up to one year. Therefore, the Service requires multi-year beach compaction monitoring and, if necessary, tilling to ensure that project impacts on sea turtles are minimized. A root rake with tines at least 42 inches long and less than 36 inches apart pulled through the sand is recommended for compacted beaches. Service policy calls for beaches to be tilled if compaction levels exceed 500 pounds per square inch (psi).

A change in sediment color on a beach could change the natural incubation temperatures of nests within an area, which, in turn, could alter natural sex ratios. To provide the most suitable sediment for nesting sea turtles, the color of the nourished sediments must resemble the natural beach sand in the area.

Natural reworking of sediments and bleaching from exposure to the sun would help to lighten dark nourishment sediments; however, the time frame for sediment mixing and bleaching to occur could be critical to a successful sea turtle nesting season.

On nourished beaches, steep escarpments may develop along water line interfaces as the beaches adjust from the unnatural, construction profile to a more natural beach profile (USACE, 1984; Nelson et al., 1987). These escarpments can hamper or prevent access to nesting sites. Researchers have shown that female turtles coming ashore to nest can be discouraged by the formation of an escarpment, leading to situations where they choose marginal or unsuitable nesting areas to deposit eggs (e.g., in front of the escarpments, which often results in failure of nests due to prolonged tidal inundation). This impact can be minimized by leveling any escarpments prior to the nesting season.

Beach disposal of project dredge material would constitute a form of beach nourishment within the project area. According to Pilkey and Dixon (1996), beach replenishment frequently leads to more development in greater density within shorefront communities that are then left with a future of further replenishment or more drastic stabilization measures. Dean (1999) also notes that the very existence of a beach nourishment project can encourage more development in coastal areas. Following completion of a beach nourishment project in Miami during 1982, investment in new and updated facilities substantially increased tourism there (NRC, 1995). Increased building density immediately adjacent to the beach often resulted as older buildings were replaced by much larger ones that accommodated more beach users. Overall, shoreline management creates an upward spiral of initial protective measures resulting in more expensive development which leads to the need for more and larger protective measures. Increased shoreline development may adversely affect sea turtle nesting success. Greater development may support larger populations of mammalian predators, such as foxes and raccoons, than undeveloped areas (NRC, 1990), and can also result in greater adverse effects due to artificial lighting, as discussed above.

Piping Plover

Beneficial Effects: The Service is not aware of any substantial beneficial effects of the action within the project area for piping plovers. A slight net increase in piping plover habitat post-construction could occur if intertidal flats furnish foraging habitat as a result of sediment disposal operations. However, the disposal of dredge sediments will likely bury or destroy prey organisms (Donoghue, 1999).

Direct Effects: The construction operation (i.e., inlet dredging and disposal of sand) would extend through part of one piping plover wintering season (2001) and the maintenance disposal operations would extend through approximately 16 migrating and wintering seasons during the life of the project (estimated at 1 dredging / 3 years for 50 years). Heavy machinery and equipment (e.g., trucks and bulldozers operating on project area beaches, the placement of the hydraulic pipeline along the beach, and sand disposal) may also adversely affect migrating and overwintering piping plovers by disrupting normal beach uses such as resting and feeding, causing birds to expend valuable energy reserves. In addition, beaches that have recently received sand could have fewer invertebrates as a food source than natural beaches.

By stabilizing the inlet channel within the narrowly defined corridor and preventing the dynamic and natural coastal processes (e.g., overwash, inlet migration, etc.) From occurring, a majority of this area will be subject to succession (i.e., the colonization of vegetation communities) thereby rendering it unsuitable and uninhabitable for this species for the life of the project. Currently, a significant portion of the project

action area is suitable habitat for nesting, resting, and foraging plovers, and the constant creation and formation of new habitats ensures the species has adequate resources available necessary for its survival. The loss of this habitat could lessen the available habitat necessary to sustain overwintering birds, forcing them to seek suitable habitat outside of the project area. The displacement of these birds could, in turn, affect areas which other birds utilize by reducing their available roosting and/or foraging habitat and increasing intraspecific competition.

Indirect Effects: Sand placement on area beaches may reduce the occurrence of overwash areas. Piping plovers nest on such overwash areas that are created by the flow of water through the primary dune line. Water flowing through the dune deposits sand on barrier flats and marshes depending on the storm magnitude and the width of the beach. Cross island overwashes create and maintain intertidal bayside flats that are valuable shorebird foraging habitats. Nests may be established on the portion of storm-created areas and adjacent areas that are relatively dry during the nesting season, and the birds may feed on those portions that stay moist (USFWS, 1996a). These moist areas are key to plover feeding during migration and overwintering as well. Displacement of dredged sand from Shallotte Inlet robs material from the tidal deltas that form prime intertidal foraging habitats at naturally functioning inlets. The combined effects of removing sand that would normally form intertidal flats from the new inlet and depositing it along the barrier island beach where it will impede overwash will be perpetuated over the project life, and are likely to persist for some years thereafter, even if inlet maintenance ceases. Furthermore, these impacts will occur in a region where prime habitats formed by naturally functioning inlets are already severely reduced by past and on-going projects. Thus, options for affected plovers to find suitable alternative habitats in the vicinity are already limited.

Repetitive, beach disposal of dredge sediments is likely to adversely affect beach invertebrate populations, a food source for piping plovers. These populations are a key facet of the coastal food web, and therefore decreased species abundances would reduce the prey base for shorebirds, surf fishes, and beach invertebrate macrofauna. Once maintenance dredging begins, Ocean Isle Beach will receive additional sand placement on a three year cycle for 50 years. This periodic beach disposal of dredge material over many years may permanently depress beach invertebrate populations (Donoghue, 1999). Thus, the project may reduce foraging habitat for nesting, migrating, and overwintering plovers. Piping plovers that cannot find sufficient food within the project area would be forced to move to feeding sites outside the actual sediment disposal areas.

Beach invertebrates may take a year or more to recover from beach disposal (Reilly and Bellis, 1978; Donoghue, 1999). The long term impacts of these repetitive sand placements on beach invertebrates and the shorebirds which feed on them is uncertain, but is most likely to be a degradation of habitat value. Impacts on piping plover survival rates are likely to be more severe during periods of peak energetic demand including the first weeks after hatching, during migration, and during and after harsh winter weather. As discussed above, the displacement of birds from the project area could also negatively affect nearby birds by congregating animals in areas and reducing available feeding or roosting habitats.

In addition, piping plovers may also be adversely affected by future development, increased commercial and recreational use of the inlet, and by increased human and pet traffic disturbance. While it is likely that future development within the project area would be limited due to building and lot size restrictions that are normally associated with ocean hazard areas (15A NCAC 07H .0300), past development within the action area has created the situation that necessitates the proposed action.

C. Species' Response to the Proposed Action

Seabeach Amaranth

The disposal of dredged sediments on the project beach could bury existing plants if the disposal operations are conducted during the growing season. Sediment disposal at any time of year could also bury seeds to a depth that would prevent germination.

Sediment disposal on beaches could also have positive impacts on seabeach amaranth by creating additional habitat for the species. Although more study is needed before the long-term impacts can be accurately assessed, several populations are shown to have established themselves on beaches receiving dredged sediments, and have thrived through subsequent applications of dredged material (Weakley and Bucher, 1992).

West Indian Manatee

Dredging operations conducted during the warm water summer months may injure or kill manatees if individuals are present within the area of operation. Dredge and sediment disposal activities may also destroy areas of aquatic vegetation, the manatee's food source. However, boat strikes resulting from the dredging operations are most likely to be the major cause of injury or death to manatees. The disposal of dredged sediments at any time of the year are likely to have little affect on transient manatees.

Sea Turtles

Ernest and Martin (1999) conducted a comprehensive study to assess the effects of beach nourishment on loggerhead sea turtle nesting and reproductive success. The following findings illustrate sea turtle responses to and recovery from a sediment disposal project. A significantly larger proportion of turtles emerging on nourished beaches abandoned their nesting attempts than turtles emerging on Control or pre-nourished beaches. This reduction in nesting success was most pronounced during the first year following project construction and is most likely the result of changes in physical beach characteristics associated with the sediment disposal project (e.g., beach profile, sediment grain size, beach compaction, frequency and extent of escarpments). During the first post-construction year, the time required for turtles to excavate an egg chamber on the untilled, hard-packed sands of one treatment area increased significantly relative to Control and background conditions. However, in another treatment area, tilling was effective in reducing sediment compaction to levels that did not significantly prolong digging times. As natural processes reduced compaction levels on nourished beaches during the second post-construction year, digging times returned to background levels.

During the first post-construction year, nests on the nourished beaches were deposited significantly farther from both the toe of the dune and the tide line than nests on control beaches. Furthermore, nests were distributed throughout all available habitat and were not clustered near the dune as they were in the Control. As the width of nourished beaches decreased during the second year, among-treatment differences in nest placement diminished. More nests were washed out on the wide, flat beaches of the nourished treatments than on the narrower steeply sloped beaches of the Control. This phenomenon persisted through the second post-construction year monitoring and resulted from the placement of nests

near the seaward edge of the beach berm where dramatic profile changes, caused by erosion and scarping, occurred as the beach equilibrated to a more natural contour.

As with other beach nourishment projects, Ernest and Martin (1999) found that the principal effect of sediment disposal on sea turtle reproduction was a reduction in nesting success during the first year following project construction. Although most studies have attributed this phenomenon to an increase in beach compaction and escarpment formation, Ernest and Martin indicate that changes in beach profile may be more important. Regardless, as a nourished beach is reworked by natural processes in subsequent years and adjusts from an unnatural construction profile to a more natural beach profile, beach compaction and the frequency of escarpment formation decline, and nesting and nesting success return to levels found on natural beaches.

Piping Plover

Limited information is available on the specific effects of dredge and disposal projects on nesting, migrating, and wintering piping plovers. Most research has focused on the general impacts of human disturbance (e.g., Burger, 1991; 1994; Collazo et al., 1995), or other measurable impacts to resources used by plovers (e.g., Reilly and Bellis, 1978; Donoghue, 1999). However, the results of human disturbance are closely related to the indirect effects of a dredge and disposal project on piping plovers. Habitat loss and disturbance associated with human development are the most frequently cited causes of the decline of the species.

Dredge and disposal operations can be beneficial or detrimental to plovers depending on the timing and location of the operations. If nesting habitat is more limited than nearby foraging habitat, the deposition of dredged material can be beneficial to nesting plovers. A project may improve the quality and availability of nesting habitat if the spoil material results in the creation of areas that are higher, wider, and less vegetated than the pre-disposal site. However, the disposal operation often increases the use of the area by humans, which results in an increase in human-caused disturbance of adults and juveniles or mortality of eggs and chicks. In general, coastal development and stabilization activities degrade nesting, roosting, and foraging habitats used by piping plovers by altering the natural processes of beach dune and inlet erosion and accretion. The construction of recreational, residential, and commercial structures not only physically alters or covers the habitat, but the increase in human and pet and feral animal use of the beaches generates greater disturbance of plovers using those habitats.

The geographical location of North Carolina makes it unique in its use of habitats by piping plovers during the breeding and non-breeding seasons. However, additional data are required before conclusions can be drawn on the specific impacts a dredged and disposal project might have on nesting, migrating, and wintering piping plovers.

V. Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Beach bulldozing and sandbagging (i.e., above the high tide line and not requiring a Federal permit) by private individuals or local groups and governments is another activity that may adversely affect species using project area beaches. The purpose of the proposed beach disposal is to protect beachfront buildings; however, the effort creates the impression that beachfront property will be protected from time to time by government action. In the periods between beach nourishment activities, beachfront property owners may feel compelled to provide their own interim protection. These interim protective measures may include small-scale beach bulldozing or sandbagging to create small barriers between the ocean and beachfront homes. These activities impede habitat creation and maintenance. Bulldozing and sandbagging have occurred before and after storms in the recent past on Ocean Isle Beach and is likely continue in the future.

Seabeach Amaranth - Following storms, private individuals and local governments may undertake relatively small-scale beach bulldozing and/or sandbagging operations. Such activities can destroy seabeach amaranth plants by trampling or burial.

West Indian Manatee - Increased water related recreational activities, such as boating and fishing, may seasonally effect transient manatees using the waterways within the project area during the summer months. Collisions with manatees from boats or personal watercraft could harm, harass, injure, or kill individuals.

Sea Turtles - As with seabeach amaranth, beach bulldozing and sandbagging while sea turtle nests are present on action area beaches has the potential to destroy these nests or create artificial barriers that prohibit hatchlings from reaching the shore. In addition, beach bulldozing activities could create escarpments and sandbags could create barriers that hinder females from accessing suitable nesting habitat.

Piping Plover - Beach bulldozing and sandbagging may also affect piping plovers by reducing populations of beach invertebrates used as a food source and creating artificial barriers to movement of chicks. Beach bulldozing can also destroy plover nests if conducted during the nesting season and in areas used as shelter during the migrating and wintering seasons. The greatest impact of sandbagging and bulldozing, however, is that these activities prevent overwash and the creation of new nesting, roosting, and foraging habitats.

As a result of the sediment disposal operation, the project area beach will be more readily accessible by beach-goers and residents. The increased recreationists and animal traffic could result in the destruction of eggs and nests and the flushing of birds from their nests exposing the eggs or young to predators and the elements. In addition birds may be flushed from protective habitats during the migrating or wintering seasons.

Sand fencing could also adversely affect piping plovers by altering the geomorphology of the beach, creating dunes where they might otherwise not occur. This activity adversely modifies and/or converts suitable nesting, resting, and foraging habitat and prevents the formation of suitable habitat through natural processes.

Small scale development not affected by the restrictions associated with ocean hazard areas could occur

within the species' nesting, resting or foraging habitat. The loss of these habitats could result in the displacement of birds to sites less suitable for sustaining or recovering the species.

VI. Conclusion

After reviewing the current status of seabeach amaranth, the manatee, loggerhead and green sea turtles, and the piping plover, the environmental baseline for the action area, the effects of the proposed Ocean Isle Beach Project and the cumulative effects, it is the Service's biological opinion that the Ocean Isle Beach Project, as proposed, is not likely to jeopardize the continued existence of seabeach amaranth, the manatee, loggerhead and green sea turtles, and the piping plover.

Critical habitat has not been designated for seabeach amaranth, the manatee, or loggerhead and green sea turtles in North Carolina; therefore, none would be affected. The Service proposed to designate critical habitat for wintering piping plovers on July 6, 2000 (65 FR 41782). A final decision on the designation of critical habitat for this species should be published in the Federal Register by July 6, 2001. Comments on the effects of the proposed project on the proposed designation of critical habitat for this species are included in the conference opinion. If critical habitat is formally designated, the conference opinion may be considered the Service's final opinion on the proposed project.

The proposed project will affect approximately 78.8 acres (31.8 ha; 8.6 %) of the approximate 922 acres (372 ha) of seabeach amaranth habitat in North Carolina, an undeterminable amount of aquatic habitat within Shallotte Inlet and surrounding Ocean Isle Beach seasonally utilized by the manatee in North Carolina, approximately 16.8 linear miles (27.0 km; 5.3 %) of beachfront and inlet shoreline of the approximate 320 miles (515 km) of available sea turtle nesting habitat in North Carolina, and approximately 5.9 linear miles (9.5 km; 3.9 %) of sand spits and sand and mud flats of the approximate 153 linear miles (247 km) of piping plover habitat proposed for designation as critical habitat in North Carolina. Research has shown that the principal effect of beach nourishment on sea turtle reproduction is a reduction in nesting success, and this reduction is most often limited to the first year following project construction. Research has also shown that the impacts of a nourishment project on sea turtle nesting habitat are typically short-term because a nourished beach will be reworked by natural processes in subsequent years, and beach compaction and the frequency of escarpment formation will decline. Inlet dredging and sediment disposal impacts on nesting, foraging, and roosting piping plovers are also short-term; however, the severity of the effects increase with repetitive activities, especially when they do not allow the natural dynamism of the environment to occur. Although a variety of factors, including some that cannot be controlled, can influence how a nourishment project will perform from an engineering perspective, measures can be implemented to minimize impacts to seabeach amaranth, manatee, sea turtles, and piping plover.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent

actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require a contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impacts on the species to the Service as specified in the incidental take statement (50 CFR § 402.14(i)(3)).

AMOUNT OR EXTENT OF INCIDENTAL TAKE

Seabeach Amaranth -- Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally-listed endangered plants or the malicious damage of such plants on areas under federal jurisdiction, or the destruction of endangered plants on non-federal areas in violation of state law or regulation or in the course of any violation of a State criminal trespass law. Applicable provisions of the North Carolina Plant Protection and Conservation Act (GS 106-202.12 to 202.22) should be followed.

West Indian Manatee – The Service is not including an incidental take authorization for marine mammals at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 Amendments. Following issuance of such regulations or authorizations, the Service may amend this biological opinion to include an incidental take statement for marine mammals, as appropriate.

Sea Turtles -- The Service anticipates approximately 3.25 linear miles (5.2 km) of nesting beach habitat on Ocean Isle Beach could be taken as a result of this proposed action. Based on the review of biological information and other information relevant to this action, incidental take is anticipated to be in the form of: (1) destruction of all sea turtle nests that may be constructed and eggs that may be deposited and missed by a nest survey and egg relocation program within the boundaries of the proposed project; (2) destruction of all sea turtle nests deposited when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) harassment in the form of disturbing or interfering with female turtles attempting to nest within the nourishment area or on adjacent beaches as a result of nourishment activities; (5) disorientation of hatchling turtles on beaches adjacent to the nourishment area as they emerge from the nest and crawl to the water as a result of project lighting; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting

areas to deposit eggs; and, (7) destruction of all nests destroyed as a result of escarpment leveling within a nesting season when such leveling has been approved by the Service.

Incidental take is anticipated for only the 3.25 linear miles (5.2 km) of nesting beach habitat on Ocean Isle Beach that have been identified for sediment disposal. The Service anticipates incidental take of sea turtles will be difficult to detect for the following reasons: (1) turtles nest primarily at night and all nests are not found because (a) natural factors, such as rainfall, wind, and tides may obscure crawls, and (b) human-caused factors, such as pedestrian traffic, may obscure crawls, and result in nests being destroyed because they were missed during a nesting survey and egg relocation program; (2) the total number of hatchlings per undiscovered nest is unknown; (3) the reduction in percent hatching and emerging success per relocated nest over the natural nest site is unknown; (4) an unknown number of females may avoid the project beaches and be forced to nest in a less than optimal area; (5) lights may disorient an unknown number of hatchlings and cause death; and, (6) escarpments may form and cause an unknown number of females from accessing a suitable nesting site. However, the level of take of these species can be anticipated by the disturbance of suitable turtle nesting beach habitat because: (1) turtles nest within the project site; (2) sediment disposal will likely occur during a portion of the nesting season; (3) the sediment disposal project will modify the incubation substrate, beach slope, and sand compaction; and, (4) artificial lighting will disorient nesting females and hatchlings.

Piping Plovers - Based on historic use of the project area by nesting piping plovers, the Service anticipates no more than one (1) nesting pair of piping plovers on the approximately xxx acres (xxx hectares) of sand spits, sand and mud flats, and tidal salt marsh and creek between the west end of Holden Beach and the east end of Sunset Beach could be taken (harassment and harm) as a result of this proposed action. Based on the review of biological information and other information relevant to this action, harassment and harm is anticipated to be in the form of: (1) the loss of nesting opportunities within the project area that are designated to receive sand placement or be dredged due to disturbances associated with nourishment activities; (2) disturbing or interfering with piping plovers attempting to nest, forage, or roost within the project area or on adjacent beaches as a result of nourishment activities; (3) disturbing or interfering with piping plovers attempting to nest, feed, or roost within the project area or on adjacent beaches as a result of increased recreational, pedestrian or animal traffic; (4) behavior modification of piping plovers due to disturbances associated with nourishment activities within the project area during the nesting season, resulting in failed nest attempts or situations where they choose marginal or unsuitable nesting areas; and, (5) decreased survivorship of nesting piping plovers due to diminished quantity and quality of foraging habitats at the newly created inlet, compared with flood tidal deltas at naturally functioning and migrating inlets. No incidental take is anticipated, nor exempted, for the abandonment or destruction of active piping plover nests. Should an active nest be found, protective measures detailed under the terms and conditions shall be implemented.

The Service also anticipates approximately **xxx acres (xxx hectares)** of habitat loss directly impacted within the project area boundaries and an additional undeterminable amount of sand spits, sand and mud flats, and tidal salt marshes and creeks indirectly impacted on Ocean Isle Beach as well as Holden Beach, and Sunset Beach could be taken as a result of this proposed action. This habitat loss equates to an undeterminable number of piping plovers that will be taken (harassed and harmed) during both the breeding and non-breeding seasons. Non-breeding season impacts are expected because (1) piping plovers migrate and overwinter within the action area; (2) the effects of the inlet relocation will likely occur during a portion of the migrating and wintering seasons; and, (3) the inlet relocation project will

modify the hydrology, beach slope, and habitats utilized for feeding and roosting by the plovers. The Service anticipates incidental take of non-breeding piping plovers will be particularly difficult to detect because: (1) migrating and wintering plovers are not as easy to identify as breeding birds because they lose some of the markings associated with their breeding plumage and often congregate with other similar looking shorebirds; (2) the effects of intraspecific competition are difficult to measure; and, (3) reduction in reproductive success on the breeding grounds will be difficult to measure if the plover on the wintering grounds is unidentifiable (no bands present). Based on the review of biological information and other information relevant to this action, incidental take (harassment and harm) is anticipated to be in the form of: (1) disturbing or interfering with piping plovers attempting to forage or roost within the project area or on adjacent beaches as a result of increased recreational, pedestrian or animal traffic; (2) behavior modification of piping plovers during the migrating and wintering seasons due to disturbances associated with nourishment activities within the project area, resulting in excessive energy expenditures, displacement of individual birds, increased foraging behavior, or situations where they choose marginal or unsuitable resting or foraging areas; and, (3) decreased survivorship of migrating and wintering piping plovers due to diminished quantity and quality of foraging habitats at the newly created inlet, compared with flood tidal deltas at naturally functioning and migrating inlets.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 USC § 703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to seabeach amaranth, the manatee, loggerhead and green sea turtles, or the piping plover.

REASONABLE AND PRUDENT MEASURES

Reasonable and Prudent Measures: All Species

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize take of the manatee, loggerhead and green sea turtles and the piping plover:

7. Only high-quality, beach-compatible sand should be deposited on Ocean Isle Beach as part of this project;

8. If the construction phase will be conducted during the seabeach amaranth growing season (April 1 through September 30), surveys for seabeach amaranth shall be conducted prior to the start of any sediment disposal and again prior to any tilling operation. If plants are found within the area of sediment disposal or tilling, the plants shall be protected with an adequate buffer zone;

9. The Corps and the applicant shall ensure that contractors doing the work fully understand the seabeach amaranth protection measures detailed in this opinion;

10. If the project will be conducted during the summer months of June through October, observations

for manatees shall be conducted to minimize the potential impacts resulting from dredging operations. If manatees are observed within the area of dredging operations, avoidance measures will be taken to minimize impacts to the species;

11. The Corps and the applicant shall ensure that contractors doing the work fully understand the manatee protection measures detailed in this opinion;

12. If the project will be conducted during the sea turtle nesting season (May 1 through November 15), surveys for nesting turtles shall be conducted daily prior to the start of any work. If nests are constructed in the area of sediment disposal, the eggs shall be relocated following the protocols of a nest relocation program approved of by the NCWRC and the Service;

13. Immediately after completion of the project and prior to the next three nesting seasons, beach compaction will be monitored and tilling shall be conducted as required to reduce the likelihood of impacting sea turtle nesting and hatching activities;

14. Immediately after completion of the project and prior to the next three nesting seasons, monitoring shall be conducted to determine if escarpments are present, and escarpments shall be leveled as required to reduce the likelihood of impacting sea turtle nesting and hatching activities;

15. The Corps and the applicant shall ensure that contractors doing the work fully understand the sea turtle protection measures detailed in this incidental take statement;

16. During the sea turtle nesting season, construction equipment and pipes shall be stored in a manner that will minimize impacts to sea turtles to the maximum extent practicable;

17. During the sea turtle nesting season, lighting associated with the project shall be minimized to reduce the possibility of disrupting and disorienting nesting and/or hatchling sea turtles;

18. Xxx In order to minimize impacts to sea turtles from the effects of lighting within the action area, a lighting ordinance shall be implemented and enforced (specifically during the sea turtle nesting season) on all ocean-facing or beachfront structures and facilities on Ocean Isle Beach;

19. If project construction will be conducted during the piping plover nesting season (April 1 through July 15), surveys for nesting plovers shall be conducted daily. If nests are constructed in the area of construction activities, the nests shall be protected with a fence and an adequate buffer zone following the protocols of a nest protection program approved of by the NCWRC and the Service;

20. The Corps and the applicant shall ensure that contractors doing the work fully understand the piping plover protection measures detailed in this incidental take statement;

21. During the piping plover nesting season, construction equipment and associated materials shall be stored in a manner that will minimize impacts to piping plovers to the maximum extent practicable;

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Terms and Conditions: All Species

A report describing the actions taken to implement the terms and conditions of this incidental take statement shall be submitted to the Service's Raleigh Field Office, Post Office Box 33726, Raleigh, North Carolina 27636-3726 within 60 days of completion of the proposed work. This report will include the status of the species – seabeach amaranth, manatees, nesting loggerhead and green sea turtles, and nesting, migrating, and wintering piping plovers – addressed in this opinion and any known impacts, either beneficial or adverse, of the project upon completion of the construction phase and following each maintenance phase, inclusive of the years between each operational event. The dates of actual construction activities and the names and qualifications of personnel involved in species surveys should also be included. The biological and geographical scope of these reports shall not be limited to areas of actual disposal, but each report shall encompass all areas within the project action area.

Terms and Conditions: Seabeach Amaranth

1. Seabeach amaranth surveys shall be required if any portion of the sediment disposal project or tilling operation occurs during the period April 1 through September 30. Plant surveys shall be initiated prior to sediment disposal and/or tilling activities. If plants are discovered in areas where they may be affected by sediment disposal, and/or tilling and construction activities, the plants shall be protected by an adequate buffer zone. The protected area shall not identify the plants to protect them from collectors, but shall be of adequate size to obscure the specific plant site.

Terms and Conditions: West Indian Manatee

1. The Corps and/or applicant will inform all personnel associated with the project that manatees may be present in the project area, primarily during the months June through October, and the need to avoid any harm to these endangered mammals. The Corps/applicant will ensure that all construction personnel know the general appearance of the species and their habit of moving about completely or partially submerged in shallow water. All construction personnel will be informed that they are responsible for observing water-related activities for the presence of manatees.

2. The Corps and/or applicant will advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Act and the Marine Mammal Protection Act of 1972, as amended.

3. If a manatee is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure protection of the manatee. The precautions shall include the operation of all moving equipment no closer than 50 feet of a manatee. Operation of any equipment closer than 50 ft (15.2 m) to a manatee shall necessitate

immediate shutdown of the equipment. Activities will not resume until the manatee has departed the project area of its own volition. Manatees should not be herded away or harassed into leaving.

4. Any collision with and/or injury to a manatee will be reported immediately. The report must be made to the Service's Raleigh Field Office (919.856.4520), the Service's Law Enforcement Office (919.856.4786), and the Commission (Mr. Tom Henson, 919.946.1969) immediately, and dredging should be postponed until cause of injury or mortality can be determined and a revised dredging and or monitoring plan is produced and approved by the Service.

5. A sign should be posted in all vessels associated with the project where it is clearly visible to the vessel operator. The sign should state:

> CAUTION: The endangered manatee may occur in these waters during the warmer months, primarily from June through October. Idle speed is required if operating this vessel in shallow water during these months. All equipment must be shut down if a manatee comes with 50 ft (15.2 m) of operating equipment. A collision with and/or injury to a manatee will be reported immediately to the U.S. Fish and Wildlife Service at 919.856.4520 and the North Carolina Wildlife Resources Commission at 919.946.1969.

6. The applicant/contractor will maintain a log detailing sightings, collisions, or injuries to manatees during project construction. After construction, the applicant/contractor will prepare a report which summarizes all information on manatees during construction. This report will be submitted to the Service's Raleigh Field Office and the Commission.

7. All vessels associated with the construction project will operate at "no wake/idle" speeds at all times while in water where the draft of the vessel provides less than four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

8. If siltation barriers must be placed in shallow water, these barriers will be: (a) made of material in which manatees cannot become entangled; (b) secured in a manner that they cannot break free and entangle manatees; and, (c) regularly monitored to ensure that manatees have not become entangled. Barriers will be placed in a manner to allow manatees entry to or exit from essential habitat.

Terms and Conditions: Sea Turtles

9. All fill material placed on beaches shall be sand that is similar to that already existing at the beach site in both coloration and grain size distribution. All such fill material shall be free of construction debris, rocks, organic materials, or other foreign matter and shall generally not contain, on average, greater than 10 percent fines (i.e., silt and clay; passing the # 200 sieve) and shall not contain, on average, greater than 5 percent coarse gravel or cobble, exclusive of shell material (retained by the # 4 sieve).

10. Daily early morning sea turtle nesting surveys shall be required if any portion of the sediment disposal project occurs during the period from May 1 through November 15. Nesting surveys

shall be initiated 65 days prior to sediment disposal activities or by May 1, whichever is later. Nesting surveys shall continue through the end of the project or through November 15, whichever is earlier. If nests are constructed in areas where they may be affected by construction disposal activities, eggs shall be relocated per the following requirements.

2a. Nesting surveys and egg locations shall only be conducted by personnel with prior experience and training in nest survey and egg relocation procedures. Surveyors shall have a valid North Carolina Wildlife Resources Commission permit. Nest surveys shall be conducted daily between sunrise and 9 a.m. Surveys shall be performed in such a manner so as to ensure that construction and maintenance activities do not occur in any location prior to completion of the necessary sea turtle protection measures.

2b. Only those nests that may be affected by construction activities shall be relocated. Nests requiring relocation shall be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Nest relocations in association with construction activities shall cease when construction activities no longer threaten nests. Nests deposited within the areas where construction activities have ceased or will not occur for 65 days shall be marked and left in place unless other factors threaten the success of the nest. Any nests left in the active construction zones shall be clearly marked, and all mechanical equipment shall avoid nests by at least 10 ft (3 m). The nest site shall also be cleared of materials or equipment that could potentially block passage of hatchlings from leaving the nest and approaching the ocean.

11. Immediately after completion of sediment placement on beaches and prior to April 1 for three subsequent years, sand compaction shall be monitored in the placement area in accordance with a protocol agreed to by the Service, the State regulatory agency, and the Corps. At a minimum, the protocol provided under 3a and 3b below shall be followed. If required, the area shall be tilled to a depth of 36 inches. All tilling activity must be completed prior to April 1. If the project is completed during the nesting season, tilling shall not be performed in areas where nests have been left in place or relocated. A report on the results of compaction monitoring shall be submitted to the Service prior to any tilling actions being taken. An annual summary of compaction surveys and the actions taken shall be submitted to the Service. This condition shall be evaluated annually and may be modified if necessary to address sand compaction problems identified during the previous year. (NOTE: The requirement for compaction monitoring can be eliminated if the decision is made to till regardless of post-construction compaction levels. Also, out-year compaction monitoring and remediation are not required if placed material no longer remains on the beach.)

3a. Compaction sampling stations shall be located at 500 ft (152 m) intervals along the placement area. One station shall be at the seaward edge of the dune line (when material is placed in this area); and one station shall be midway between the dune line and the high water line (normal wrack line).

At each station, the cone penetrometer shall be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to

ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lay over less compact layers. Replicates shall be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth shall be averaged to produce final values for each depth at each station. Reports shall include all 18 values for each transect line, and the final six averaged compaction values.

3b. If the average value for any depth exceeds 500 psi for any two or more adjacent stations, then that area shall be tilled immediately prior to April 1. If values exceeding 500 psi are distributed throughout the placement area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the Service shall be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the placement area, tilling shall not be required.

12. Sand compaction data shall be collected on beaches scheduled for sediment disposal prior to the disposal operation following the protocols described above. Such pre-disposal beach compaction data would establish a range of values for areas in which sea turtles actually nest. These data would form a valuable baseline for comparison with post-disposal compaction values and could influence the necessity for post-disposal tilling.

13. Visual surveys for escarpments along the project area shall be made immediately after completion of the sediment placement and prior to April 1 for three subsequent years. Results of the surveys shall be submitted to the Service prior to any action being taken. Escarpments that interfere with sea turtle nesting or exceeds 18 inches in height for a distance of 100 ft (30 m) shall be leveled to the natural beach contour by April 1. The Service shall be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or exceeds 18 inches in height for a distance of 100 ft (30 m) occurs during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the Service will provide a brief written authorization that describes methods to be used to reduce the likelihood of impacting existing nests. An annual summary of escarpment surveys and actions taken shall be submitted to the Service. (NOTE: Out-year escarpment monitoring and remediation are not required if placed material no longer remains on the beach.)

14. The applicant shall arrange a meeting between representatives of the contractor, the Service, the Commission, and the permitted person responsible for egg relocation at least 30 days prior to the commencement of work on this project. At least 10 days advance notice shall be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the sea turtle protection measures.

15. From May 1 through November 15, staging areas for construction equipment shall be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all construction pipes that are placed on the beach shall be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system.

Temporary storage of pipes shall be off the beach to the maximum extent possible. Temporary storage of pipes on the beach shall be in such a manner so as to impact the least amount of nesting habitat and shall likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline is recommended as the method of storage).

16. From May 1 through November 15, all lighting associated with the project shall be limited to the immediate area of active construction only and shall be the minimal lighting necessary to comply with safety requirements. Shielded low pressure sodium vapor lights are recommended to minimize illumination of the nesting beach and nearshore waters. Lighting on offshore equipment shall be minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and Occupational Safety and Health Administration requirements. Shielded low pressure sodium vapor lights are highly recommended for lights on offshore equipment that cannot be eliminated.

17. Xxx The applicant, in coordination with the Corps and the Service, will implement and enforce a lighting ordinance to minimize the impacts to nesting and hatchling sea turtles. The Service is willing to assist the applicant in the development of the lighting ordinance (e.g., see Witherington and Martin, 2000).

18. A report describing the actions taken to implement the terms and conditions of this incidental take statement shall be submitted to Mr. Dale Suiter of the Service's Raleigh Field Office within 60 days of completion of the proposed work. This report will include the dates of actual construction activities, names and qualifications of personnel involved in nest surveys and relocation activities, descriptions and locations of self-release beach sites, nest survey and relocation results, and hatching success of nests.

19. In the event a sea turtle nest is excavated during construction activities, the permitted person responsible for egg relocation for the project should be notified so the eggs can be moved to a suitable relocation site.

20. Upon locating a dead, injured, or a sick sea turtle specimen, initial notification must be made to Mr. David Allen, Non-game Coastal Project Leader for the Commission, located in Trenton, NC at 252-448-1546 prior to transporting live debilitated turtles to a rehabilitation facility or disposing of carcasses. Care shall be taken in handling sick or injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of a sick or injured sea turtle or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not disturbed.

The Service believes that incidental take of sea turtles will be limited to the 3.25 linear miles (5.2 km) of nesting beach habitat that has been identified for sand placement. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes that no more than the following types of incidental take will result from the proposed action: (1) destruction of all sea turtle nests that may be constructed and eggs that may be deposited and missed by a nest survey and egg relocation program within the boundaries of the proposed project; (2) destruction of all sea turtle nests deposited during the

period when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities; (5) disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and, (7) destruction of all nests destroyed as a result of escarpment leveling within a nesting season when such leveling has been approved by the Service. The amount or extent of incidental take for sea turtles will be considered exceeded if the project results in sediment disposal occurring more than once on the 3.25 linear miles (5.2 km) of beach shoreline identified for sand placement without reinitiation of consultation and/or the prior written consent of the Service. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal action agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Terms and Conditions: Piping Plover

1. A monitoring program for breeding and non-breeding piping plovers must be implemented; daily during the construction phase and weekly (no less than every six days) when no activity is scheduled. Monitoring of piping plovers must be initiated immediately, or by March 1, 2001, whichever is earlier. A quarterly report must be prepared by the applicant on the previous breeding, migrating, and wintering season data and submitted to the Service and the Commission; an annual report must be submitted by April 30 of every year summarizing the previous year's data. The reports will be reviewed and the scheduled timing and/or frequency of surveys shall be adjusted accordingly. The Service and the Commission shall approve the timing of surveys, any protocol for selecting areas to be surveyed, any protective markings or symbolic fencing around nests, the establishment of protective buffer zones, and work restrictions within protective buffer zones. The applicant shall ensure that the monitoring program is adequately funded.

   Monitoring for piping plover nesting may be limited to those areas that match established criteria necessary for the survival of piping plovers (e.g., accreting areas at inlets; bayside, sand, and mud flats; or, recently disturbed areas such as washover areas), but should include the southern end of Holden Beach and all of Ocean Isle Beach. Monitoring should be conducted daily during the time of territory establishment, courtship, and copulation (March 1 through July 15) of the construction year or during the construction operations, whichever is longer. In addition to nesting pair counts and productivity data, monitoring of breeding sites should include other information important to determine of site protection needs. Whenever possible, data collection should include (USFWS, 1996a):

   a. dates when monitoring began and ended;
   b. nesting chronology (dates when plovers were first seen on the site, nest establishment dates, dates when unfledged chicks are present on the site);
   c. locations of nests and brood foraging territories;
   d. known and suspected causes of nest and chick loss;

e. indices of predator abundance;
f. locations of commonly used foraging areas during each stage of the breeding cycle; and,
g. use of the site by post-breeding or migrating plovers.

The applicant, in coordination with the Service and the Commission, should develop a plan to protect piping plover nests in the project area. The protective plan should implement appropriate protective measures (e.g., post and fence nest areas) to restrict access of people, animals, vehicles, and other machinery and/or equipment to nests and chicks, but not restrict movements of the adult and juvenile birds. Typically, a buffer zone of approximately 500 ft (150 m) is required to protect nests and juveniles prior to fledging.

Monitoring for non-breeding plovers should be conducted weekly (no less than every six days) during the migrating and the overwintering periods (July 15 through March 15) and year-round during years when no activity is scheduled. Piping plovers exhibit diurnal shifts in habitat use; therefore, observations should be conducted for the minimum amount of daylight hours, including 30 minutes after sunrise to 30 minutes before sunset, and should be evenly distributed throughout this period, including a wide range of tidal conditions and habitat types. The amount of time necessary to survey each site will depend on the amount and type of habitat to be covered; areas should be surveyed slowly and thoroughly.

Monitoring piping plovers can be difficult because they appear to depend on a variety of habitats, and habitat use varies depending on tidal regime, weather conditions, season, and disturbance. Plovers are often found in tight clusters on prime feeding sites, and may be overlooked, especially in large shorebird concentrations. While some ornithologists find censussing of plovers on roosting habitat to be the most efficient (Fussell, 1990), an inexperienced eye may easily miss a cluster of roosting plovers because they are often huddled down in the sand or along the wrack line (Eubanks, 1992). Monitoring should not be conducted during poor weather (winds > 25 mph, heavy rain, severe cold) since birds may seek protected areas during these times.

The Corps, the Service, and the Commission should coordinate on the exact data to be collected by the monitoring program. At the very least, these data should include: (1) the date, time, and location of each observation; (2) the number of birds seen; (3) the microhabitat of the occurrence (e.g., sand and mud flats, beach, etc.); (4) the activity of the birds (e.g., foraging, roosting, courtship, brooding rearing, etc.); and, (5) any visible markings or identifying features (i.e., leg bands). Observers should be able to recognize bands on piping plovers from any of the three breeding populations, but specifically the endangered Great Lakes population. The presence of birds from the Great Lakes population should be reported immediately to the Service and the Commission.

2. The applicant, in coordination with the Corps and the Service, will devise and implement a plan to minimize the impacts to nesting piping plovers during the initial construction phase, to include: (1) minimizing the amount of heavy equipment in the project area at any given time; (2) not storing heavy equipment within the project area; (3) minimizing the spatial extent of the work area; and, (4) cordoning-off an area to remain undisturbed during construction activities.

3. **Xxx The applicant will devise and implement a program, including enforcement, to restrict access to the sand spit, sand and mud flats, and bayside flats within the project area (southern Figure Eight Island and northern Wrightsville Beach) throughout the year upon completion of the construction operations. The restrictive access program shall consist of a barrier system, including a rope or fence partition and/or signs, clearly marking the area prohibiting human or pet admittance. In addition, the applicant, through the implementation of an ordinance or other regulation, shall enforce the program restricting access to the area. The Service would be willing to assist in the development of restricted access signs.**

4. Both the Service and the Commission shall be notified before any additional dredging, sediment placement, or other construction activities not covered in this opinion occurs in Shallotte Inlet or on Ocean Isle Beach. The notification shall include, but not limited to, species monitoring data previously collected, all available information on the material to be removed, the deposition site, and the procedures to be used to move the material. Additional construction, maintenance, or disposal activities are not covered under this opinion without prior written approval from the Service.

5. The person(s) responsible for monitoring piping plover nesting shall develop specific procedures for notifying the Service's Raleigh Field Office (Mr. Dale Suiter, 919.856.4520 extension 18), the Commission (Mr. David Allen, 252.448.1546), and the Corps (Messrs. Jeffrey Richter, 910.251.4636, or Keith Harris, 910.251.4631) in the event that construction activities result in the direct take (killing, harming, or maiming) of a piping plover. The Service, the Commission, and the Corps shall develop a standard protocol for handling dead piping plovers found during the monitoring program. This protocol shall be directed at determining the cause of death and ensuring that all banding data are recorded.

The Service believes that incidental take (harassment and harm) will be limited annually to no more than one (1) nesting pair of piping plovers on the approximately **xxx 27,562,500** ft^2 (633 acres) of sand spits, sand and mud flats, and tidal salt marsh and creek of Ocean Isle Beach that have been identified for construction operations. The Service also believes that incidental take (harassment and harm) of piping plovers will be limited to approximately **xxx 27,562,500** ft^2 (633 acres) of habitat loss directly impacted within the project area boundaries and an additional undeterminable amount of sand spits, sand and mud flats, and tidal salt marshes and creeks indirectly impacted on Holden Beach, Ocean Isle Beach and Sunset Beach **xxx Lea and Hutaff Islands, Figure Eight Island, Wrightsville Beach, and Masonboro Island** that have been identified within the action area. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes that no more than the following types of incidental take will result from the proposed action: (1) the loss of nesting opportunities within the project area that are designated to receive sand placement or be dredged due to disturbances associated with construction activities; (2) disturbing or interfering with piping plovers attempting to nest, forage, or roost within the project area or on adjacent beaches as a result of construction activities; (3) disturbing or interfering with piping plovers attempting to nest, feed, or roost within the project area or on adjacent beaches as a result of increased recreational, pedestrian or animal traffic; (4) behavior modification of piping plovers due to disturbances associated with construction activities within the project

area during the nesting season, resulting in failed nest attempts or situations where they choose marginal or unsuitable nesting areas; (5) decreased survivorship of nesting piping plovers due to diminished quantity and quality of foraging habitats at the newly created inlet, compared with flood tidal deltas at naturally functioning and migrating inlets; (6) disturbing or interfering with piping plovers attempting to forage or roost within the project area or on adjacent beaches as a result of increased recreational, pedestrian or animal traffic; (7) behavior modification of piping plovers during the migrating and wintering seasons due to disturbances associated with construction activities within the project area, resulting in excessive energy expenditures, displacement of individual birds, increased foraging behavior, or situations where they choose marginal or unsuitable resting or foraging areas; and, (8) decreased survivorship of migrating and wintering piping plovers due to diminished quantity and quality of foraging habitats at the newly created inlet, compared with flood tidal deltas at naturally functioning and migrating inlets. The amount or extent of incidental take for piping plovers will be considered exceeded if the project results in the take (harass or harm) of more than one (1) nesting pair of piping plovers and/or construction operations (including sediment disposal, dredging, etc.) occurring more than once on the approximately **xxx 27,562,500 ft^2 (633 acres, ha)** of sand spits, sand and mud flats, tidal salt marsh and creek, and oceanfront shoreline of Ocean Isle Beach **xxx Figure Eight Island and Wrightsville Beach** that have been identified for the proposed dredge and sediment disposal operation. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal action agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONFERENCE OPINION

After reviewing the current status of the piping plover, the environmental baseline for the action area, the effects of the proposed Ocean Isle Beach Project and the cumulative effects, it is the Service's conference opinion that the Ocean Isle Beach Project, as proposed, is not likely to destroy or adversely modify proposed critical habitat for overwintering piping plovers.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal action agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information.

For the benefit of seabeach amaranth, the Service recommends the following conservation recommendations:

1. The applicant should monitor seabeach amaranth for a minimum of three years following sediment disposal activities on all actual or potential beach disposal sites in order to determine the status of the seabeach amaranth population in the action area and the effects that this project has on this species. Surveys should be conducted annually in late July or August so that the number of plants reaching reproductive age can be determined. This information should be used to direct future sediment disposal activities so that seabeach amaranth will not be impacted by future

projects. A detailed report documenting the number and location of plants found should be submitted to the Service annually following each survey.

2. When sediments are scheduled for disposal on project area beaches, the material should be placed in a manner which would not harm existing seabeach amaranth plants. These precautions would include efforts to prevent the deep burial of plants.

3. Educational signs should be placed where appropriate at beach access points explaining the importance of seabeach amaranth for the stabilization of the dune system and/or the life history of seabeach amaranth in the area.

West Indian Manatee

For the benefit of sea turtles (loggerhead and green), the Service recommends the following conservation recommendations:

1. Surveys for nesting success of sea turtles should be implemented for a minimum of three years following sediment disposal to determine whether sea turtle nesting success has been adversely impacted. A coordination meeting prior to the commencement of sea turtle nest monitoring should provide an opportunity for the applicant, the Service, and the Commission to discuss additional data collection during the program. This meeting should allow the discussion of data needs and funding possibilities for such measures as Global Positioning System coordinates for each crawl and frequency of tidal inundation for each nest.

2. Educational signs should be placed where appropriate at beach access points explaining the importance of the area to sea turtles and/or the life history of sea turtle species that nest in the area.

3. Sand compaction data should be collected on all beaches scheduled for sediment disposal prior to the disposal operation. Such pre-disposal beach compaction data would establish a range of values for areas in which sea turtles actually nest. These data would form a valuable baseline for comparison with post-disposal compaction values and could influence the necessity for post-disposal tilling.

4. In addition to monitoring sand compaction and escarpment formation, the Corps, in cooperation with the Commission and local sponsors of all sediment disposal projects in North Carolina, should design and fund a research program to determine the long-term effects of beach disposal on sea turtle nesting success. This program would collect and analyze data on the physical, biological, and chemical characteristics of disposal and natural beaches and the data examined with regard to sea turtle reproductive success. The goal of the effort would be to develop methods for minimizing the adverse impacts of sediment disposal activities on sea turtle reproduction.

5. Construction activities for similar future projects should be planned to take place outside of the

main part of the sea turtle nesting and hatching season.

For the benefit of the piping plover, the Service recommends the following conservation recommendations:

1. The Corps should endeavor to create and maintain suitable piping plover nesting, migrating, and overwintering habitat. Natural accretion at inlets should be allowed to remain. Accreting sand spits on barrier islands provide excellent foraging habitat for nesting, migrating, and overwintering plovers.

2. The Corps should fund monitoring surveys for nesting, migrating, and wintering piping plovers on and around all beaches and inlets outside the action area of this project that currently receive, or are scheduled to receive, a Federally-maintained sediment disposal or inlet dredging project. This data would assist the Corps and the Service in determining the long-term impacts these routine activities have on this species and their seasonal use of these sites, and would be important in developing protective and operational measures to assist in recovery of the species. The goal of the effort would be to develop methods for minimizing the adverse impacts of sediment disposal and inlet dredging on piping plovers. A detailed report documenting the number and location of birds found and the behavior they were engaged in should be submitted to the Service annually following the wintering/migrating season.

3. A conservation/education fact sheet or display sign would be helpful in educating local beach users about the coastal beach ecosystem and associated rare species. The fact sheet/sign could highlight the piping plovers life history and basic biology and ways recreationists can assist in species protection efforts (e.g., avoiding nesting sites, keeping pets on a leash, removing trash to sealed refuge containers, etc.). The Service would be willing to assist in the development of such a fact sheet/sign, in cooperation with the Commission, interested non-governmental stakeholders (i.e., National Audubon Society, North Carolina Coastal Land Trust), the Corps, and the other interested stakeholders (i.e., City of Ocean Isle Beach, property owners, etc.).

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation and conference on the action outlined in your request for formal consultation/conference for the Ocean Isle Beach Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or, (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the overwinter piping plover critical habitat is designated. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary.

After designation of critical habitat for overwintering piping plovers and any subsequent adoption of this conference opinion, the Federal action agency shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this conference opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this conference opinion; or, (4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the project will be reviewed to determine whether any take of the habitat has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the habitat may occur between the designation of critical habitat and the adoption of the conference opinion through formal consultation, or the completion of a subsequent for consultation.

We have assigned our log number Service ID# 01-S019 to this consultation; please refer to it in any future correspondence concerning this project. If you or your staff have any questions concerning this opinion, please contact Mr. Dale Suiter of the Raleigh Field Office at (919) 856.4520 extension 18, or via email at dale_suiter@fws.gov.

Sincerely yours,

Garland B. Pardue, Ph.D.
Ecological Services Supervisor

cc: USFWS, Asheville, NC (Brian Cole)
USFWS, Atlanta, GA (Cherry Green)
USFWS, Atlanta, GA (Joe Johnston)
USFWS, Jacksonville, FL (Sandy MacPherson)
USFWS, Sudbury, MA (Anne Hecht)
USFWS, 420 South Garfield Ave., Suite 400, Pierre, SD 57501-5408 (Nell McPhillips)
USFWS, 2651 Coolidge Rd., East Lansing, MI 48823 (Jack Dingledine)
NCWRC, Raleigh, NC (Frank McBride)
NCWRC, Trenton, NC (David Allen)

LITERATURE CITED

Ackerman, R. A. 1980. Physiological and ecological aspects of gas exchange by sea turtle eggs. American Zoologist 20:575-583.

Bowen, B., J. C. Avise, J. I. Richardson, A. B. Meylan, D. Margaritoulis, and S. R. Hopkins-Murphy. 1993. Population structure of loggerhead turtles (*Caretta caretta*) in the northwestern Atlantic Ocean and Mediterranean Sea. Conservation Biology 7:834-844.

Bucher, M. A., and A. S. Weakley. 1990. Status survey of seabeach amaranth (*Amaranthus pumilus* Rafinesque) in North and South Carolina. Report to the North Carolina Plant Conservation Program, Raleigh, NC and the U.S. Fish and Wildlife Service, Asheville, NC.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research 7:39-52.

Burger, J. 1994. The effect of human disturbance on foraging behavior and habitat use in piping plover (*Charadrius melodus*). Estuaries 17:695-701.

Cairns, W. E. 1982. Biology and behavior of breeding piping plovers. Wilson Bulletin 94:531-545.

Carter, D. Personal Communication. Southern Environmental Law Center, Chapel Hill, NC.

Collazo, J. A., J. R Walters, and J. F. Parnell. 1995. Factors affecting reproduction and migration of waterbirds on the North Carolina barrier islands. Final report to the National Park Service, Cape Hatteras and Cape Lookout National Seashores.

Coutu, S.D., J. D. Fraser, J. L. McConnaughey, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Hatteras National Seashore. Unpublished report to the National Park Service.

Dean, C. 1999. Against the tide: The battle for America's beaches. Columbia University Press, New York, NY.

Dickerson D. D., and D. A. Nelson. 1989. Recent results on hatchling orientation responses to light wavelengths and intensities. Pp. 41-43 in Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology, S. A. Eckert et al., compilers. NOAA Technical Memorandum NMFS-SEFC-232.

Dodd, C. K., Jr. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service, Biological Report 88(14).

Donoghue, C. 1999. The influence of swash processes on *Donax variabilis* and *Emerita talpoida*. Ph.D. dissertation, University of Virginia, VA.

Ehrhart, L. M. 1989. Status report of the loggerhead turtle. Pp. 122-139 in Proceedings of the Second

Western Atlantic Turtle Symposium, L. Ogren et al., eds. NOAA Technical Memorandum NMFS-SEFC-226.

Elias, S. P., J. D. Fraser, and P. A. Buckley. 2000. Piping plover brood foraging ecology on New York barrier islands. Journal of Wildlife Management 64:346-354.

Encalada, S. E., K. A. Bjorndal, A. B. Bolten, J. C. Zurita, B. Schroeder, E. Possardt, C. J. Sears, and B. W. Bowen. 1998. Population structure of loggerhead turtle (*Caretta caretta*) nesting colonies in the Atlantic and Mediterranean, as inferred from mitochondrial DNA control region sequences. Marine Biology 130:567-575.

Ernest, R. G., and R. E. Martin. 1999. Martin County beach nourishment project: Sea turtle monitoring studies. 1997 Annual Report and Final Assessment. Unpublished report to Florida Department of Environmental Protection.

Eubanks, T. 1992. The piping plover in Texas: Winter survey guidelines. Draft report for Great Lakes/Northern Great Plains piping plover recovery team.

Fletemeyer, J. 1980. Sea turtle monitoring project. Unpublished report to Broward County Environmental Quality Control Board, FL.

Fussell, J. O. 1990. Census of piping plovers wintering on the North Carolina coast, 1989-1990. Unpublished report to the North Carolina Wildlife Resources Commission.

Glenn, L. 1998. The consequences of human manipulation of the coastal environment on hatchling loggerhead sea turtles (Caretta caretta, L). Pp. 58-59 in Proceedings of the Sixteenth Annual Symposium on Sea Turtle Biology and Conservation, R. Byles and Y. Fernandez, compilers. NOAA Technical Memorandum NMFS-SEFSC-412.

Goldin, M. R., and J. V. Regosin. 1998. Chick behavior, habitat use, and reproductive success of piping plovers at Goosewing Beach, Rhode Island. Journal of Field Ornithology 69:228-234.

Haig. S. M. 1985. The status of the piping plover in Canada. A Status update prepared for the committee on the status of endangered wildlife in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario, Canada.

Haig. S. M., and L. W. Oring. 1988a. Mate, site and territory fidelity in piping plover. Auk 105:268- 277.

Xxx not in document
-----, and -----. 1988b. Distribution and dispersal in the piping plover. Auk 105:630-638. Xxx

Haig, S. M., and J. H. Plissner. 1992. 1991 International piping plover census. Report to the U.S. Fish and Wildlife Service Region 3, Division of Endangered Species, Ft. Snelling, MN.

xxx not in document
-----, and -----. 1993. Distribution and abundance of piping plovers: Results and implications of

the 1991 international census. Condor 95:145-156. Xxx

xxx include? We didn't for other pers. comms.

Hecht, A. 2000. Personal Communication. Endangered Species Biologist. U.S. Fish and Wildlife Service. Great Meadows National Wildlife Refuge, MA. Xxx

Hecht, A., and G. A Moser. 1998. Northern Assateague Island restoration project and the piping plover: A case study in Endangered Species Act inter-agency consultation. Endangered Species Update. 15:31-39.

Hirth, H. F. 1997. Synopsis of the biological data on the green turtle Chelonia mydas (Linnaeus 1758). U.S. Fish and Wildlife Service, Biological Report 97:1-120.

Hopkins, S. R., and J. I. Richardson (eds.). 1984. Recovery plan for marine turtles. National Marine Fisheries Service, St. Petersburg, FL.

Lenarz, M. S., N. B. Frazer, M. S. Ralston, and R. B. Mast. 1981. Seven nests recorded for loggerhead turtle (*Caretta caretta*) in one season. Herpetological Review 12:9.

Limpus, C. J., V. Baker, and J. D. Miller. 1979. Movement induced mortality of loggerhead eggs. Herpetologica 35:335-338.

Loegering, J. P., and J. D. Fraser. 1995. Factors affecting piping plover chick survival in different brood-rearing habitats. Journal of Wildlife Management 59:646-655.

MacIvor, L. H. 1996. Biological assessment: Ocean City water resources feasibility study, immediate restoration of Assateague Island. Prepared for the U. S. Army Corps of Engineers, Baltimore District. Woodlot Alternatives, Inc. Topsham, ME.

Mann, T. M. 1977. Impact of developed coastline on nesting and hatchling sea turtles in southeastern Florida. M.S. thesis, Florida Atlantic University, FL.

[MDNR] Maryland Department of Natural Resources. 1993. Breeding biology and management of piping plovers on Assateague Island National Seashore, Maryland, 1992. Annapolis, MD.

McConnaughey, J. L., J. D. Fraser, S. D. Coutu, and J. P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore, Unpublished report to National Park Service.

McGehee, M. A. 1990. Effects of moisture on eggs and hatchlings of loggerhead sea turtles (Caretta caretta). Herpetologica 46:251-258.

Melvin, S. M. and J. P. Gibbs. 1994. Viability analysis for the Atlantic coast population of piping plovers. Unpublished report to the U. S. Fish and Wildlife Service, Sudbury, MA.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-

1992. Florida Marine Research Publications 52:1-51.

Miller, K., G. C. Packard, and M. J. Packard. 1987. Hydric conditions during incubation influence locomotor performance of hatchling snapping turtles. Journal of Experimental Biology 127:401-412.

Mrosovsky, N., and A. Carr. 1967. Preference for light of short wavelengths in hatchling green sea turtles, Chelonia mydas, tested on their natural nesting beaches. Behaviour 28:217-231.

Mrosovsky, N., and S. J. Shettleworth. 1968. Wavelength preferences and brightness cues in the water finding behaviour of sea turtles. Behaviour 32:211-257.

Murphy, T. M., and S. R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the southeast region. Final report to NMFS-SEFC.

Xxx not in document
Murray, R., and M. W. McDavit. 1993. First nest records of piping plover in South Carolina. Chat 57:10-11.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991a. Recovery plan for U.S. population of Atlantic green turtle (*Chelonia mydas*). National Marine Fisheries Service, Washington, DC.

-----. 1991b. Recovery plan for U.S. population of loggerhead turtle (*Caretta caretta*). National Marine Fisheries Service, Washington, DC.

[NPS and MDNR] National Park Service and Maryland Department of Natural Resources. 1993-1997. Management and monitoring of the piping plover at Assateague Island National Seashore, Berlin, Maryland. Annual reports.

[NRC] National Research Council. 1990. Decline of the sea turtles: Causes and prevention. National Academy Press, Washington, DC.

-----. 1995. Beach nourishment and protection. National Academy Press, Washington, DC.

[NCWRC] North Carolina Wildlife Resources Commission. 1998. ...xxx

Nelson, D. A. 1987. The use of tilling to soften nourished beach sand consistency for nesting sea turtles. Unpublished report. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Nelson, D. A. 1988. Life history and environmental requirements of loggerhead turtles. U.S. Fish and Wildlife Service Biological Report 88(23). U.S. Army Corps of Engineers TR EL-86-2 (Rev.).

Nelson, D. A., and D. D. Dickerson. 1987. Correlation of loggerhead turtle nest digging times with beach sand consistency. [Abstract]. Seventh Annual Workshop on Sea Turtle Conservation and

Biology.

Nelson, D. A., and D. D. Dickerson. 1988a. Effects of beach nourishment on sea turtles. Proceedings of the Beach Preservation Technology Conference '88. Florida Shore & Beach Preservation Association, Inc., Tallahassee, FL.

-----, and -----. 1988b. Hardness of nourished and natural sea turtle nesting beaches on the east coast of Florida. Unpublished report. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

-----, and -----. 1988c. Response of nesting sea turtles to tilling of compacted beaches, Jupiter Island, Florida. Unpublished report. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Nelson, D. A., K. Mauck, and J. Fletemeyer. 1987. Physical effects of beach nourishment on sea turtle nesting, Delray Beach, Florida. Technical Report EL-87-15. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

xxx not in document

Nicholls, J. L. 1989. Distribution and other ecological aspects of piping plovers (*Charadrius melodus*) wintering along the Atlantic and Gulf Coasts. M.S. thesis, Auburn University, AL.

Nicholls, J. L., and G. A. Baldassarre. 1990a. Winter distribution of piping plovers along the Atlantic and Gulf Coasts of the United States. Wilson Bulletin 102:400-412.

Nicholls, J. L., and G. A. Baldassarre. 1990b. Habitat associations of piping plovers wintering in the United States. Wilson Bulletin 102:581-590.

[NCWRC] North Carolina Wildlife Resources Commission. 1998. North Carolina Sea Turtle News. North Carolina Wildlife Resources Commission, Non-game and Endangered Wildlife Program. Issue 4, Summer/Fall.

Odell, D. K. 1982. West Indian manatee *Trichechus manatus*. Pp. 828-837 in Wild Mammals of North America, J.A. Chapman and G. A. Feldhamer, editors. Johns Hopkins University Press, Baltimore.

Packard, M. J., and G. C. Packard. 1986. Effect of water balance on growth and calcium mobilization of embryonic painted turtles (*Chrysemys picta*). Physiological Zoology 59(4):398-405.

Packard, G. C., M. J. Packard, and T. J. Boardman. 1984. Influence of hydration of the environment on the pattern of nitrogen excretion by embryonic snapping turtles (*Chelydra serpentina*). Journal of Experimental Biology 108:195-204.

Packard, G. C., M. J. Packard, and W. H. N. Gutzke. 1985. Influence of hydration of the environment on eggs and embryos of the terrestrial turtle Terrapene ornata. Physiological Zoology 58:564-575.

Packard, G. C., M. J. Packard, T. J. Boardman, and M. D. Ashen. 1981. Possible adaptive value of water exchange in flexible-shelled eggs of turtles. Science 213:471-473.

Packard, G. C., M. J. Packard, K. Miller, and T. J. Boardman. 1988. Effects of temperature and moisture during incubation on carcass composition of hatchling snapping turtles (Chelydra serpentina). Journal of Comparative Physiology B. 158:117-125.

Palmer, R. S. 1967. Piping plover. In The shorebirds of North America, G. D. Stout, editor. Viking Press, New York.

Palmer, W. M. and A. L. Braswell. 1995. Reptiles of North Carolina. University of North Carolina Press, Chapel Hill, NC.

Parmenter, C. J. 1980. Incubation of the eggs of the green sea turtle, *Chelonia mydas*, in Torres Strait, Australia: The effect of movement on hatchability. Australian Wildlife Research 7:487-491.

Philbosian, R. 1976. Disorientation of hawksbill turtle hatchlings, *Eretmochelys imbricata*, by stadium lights. Copeia 4:824.

Pilkey, O. H. and K. L. Dixon. 1996. The Corps and the Shore. Island Press, Washington, DC.

Plissner, J. H., and S. M. Haig. 1997. 1996 International Piping Plover Census. Report to U.S. Geological Survey, Biological Resources Division. Corvallis, OR.

-----, and -----. 2000a. Status of a broadly distributed endangered species: Results and implications of the second International piping plover census. Canadian Journal of Zoology 78:128-139.

-----, and -----. 2000b. Viability of piping plover *Charadrius melodus* metapopulations. Biological Conservation 92:163-173.

Potter, E. F., J. F. Parnell, and R. P. Teulings. 1980. Birds of the Carolinas. University of North Carolina Press, Chapel Hill, NC.

Radford, A. E., H. E. Ahles, and C. R. Bell. 1968. Manual of the vascular flora of the Carolinas. University of North Carolina Press, Chapel Hill, NC.

Rathbun, G. D., R. K. Bonde, D. Clay. 1992. The status of the West Indian manatee on the Atlantic Coast north of Florida. Pp. 152-164 in Proceedings of the symposium on nongame and endangered wildlife, R. R. Odom and J. W. Guthrie, editors. Georgia Department of Natural Resources, Game and Fish Division, Technical Bulletin WL5.

Raymond, P. W. 1984. The effects of beach restoration on marine turtles nesting in south Brevard County, Florida. M.S. thesis, University of Central Florida, FL.

Reilly, F. J., Jr., and V. J. Bellis. 1978. A study of the ecological impact of beach nourishment with dredged materials on the intertidal zone. Institute for Coastal and Marine Resources Technical

Report No. 4, Greenville, NC.

Richardson, J. I., and T. H. Richardson. 1995. An experimental population model for the loggerhead sea turtle (*Caretta caretta*). Pp. 165-176 in Biology and Conservation of Sea Turtles, K. A. Bjorndal, ed. Smithsonian Institution Press, Washington, D.C.

Ross, J. P. 1982. Historical decline of loggerhead, ridley, and leatherback sea turtles. Pp. 189- 195 in Biology and Conservation of Sea Turtles, K. A. Bjorndal, ed. Smithsonian Institution Press, Washington, D.C.

Russell, R. 1983. The piping plover in the Great Lakes region. American Birds 37:951-955.

Ryan, M. R., B. G. Root, and P. M. Mayer. 1993. Status of piping plovers in the Great Plains of North America: A demographic simulation model. Conservation Biology 7:581-585.

Schroeder, B. A. 1994. Florida index nesting beach surveys: Are we on the right track? Pp. 132-133 in Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation, K. A. Bjorndal et al., compilers. NOAA Technical Memorandum NMFS-SEFSC-351.

Schwartz, F. J. 1995. Florida manatees, *Trichechus manatus* (Sirennia: Trichechidae), in North Carolina 1919-1994. Brimleyana 22:53-60.

Spotila, J. R., E. J. Standora, S. J. Morreale, G. J. Ruiz, and C. Puccia. 1983. Methodology for the study of temperature related phenomena affecting sea turtle eggs. U.S. Fish and Wildlife Service Endangered Species Report 11.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of piping plovers subjected to human disturbance (1982-1989). Ph.D. dissertation. Tufts University, Medford, MA.

Talbert, O. R., Jr., S. E. Stancyk, J. M. Dean, and J. M. Will. 1980. Nesting activity of the loggerhead turtle (Caretta caretta) in South Carolina I: A rookery in transition. Copeia 1980:709-718.

Turtle Expert Working Group. 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (Caretta caretta) sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409.

Xxx not in document

-----. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444.

[USACE] U.S. Army Corps of Engineers. 1984. Shore Protection Manual. (Vol. 1) Coastal Engineering Research Center, Waterways Experiment Station, Vicksburg, MS.

[USFWS] U.S. Fish and Wildlife Service. 1980. Selected vertebrate endangered species of the seacoast of the United States - West Indian manatee. U.S. Fish and Wildlife Service, Biological Services

Program. FWS/OBS-80/01.35.

Xxx not in document

-----. 1988a. Atlantic Coast piping plover recovery plan. U.S. Fish and Wildlife Service, Newton Corner, MA.

-----. 1988b. Recovery plan for piping plovers breeding on the Great Lakes and Northern Great Plains. U.S. Fish and Wildlife Service, Twin Cities, MN.

-----. 1994. Draft revised recovery plan for piping plovers *Charadrius melodus* breeding on the Great Lakes and Northern Great Plains. U.S. Fish and Wildlife Service, Twin Cities, MN.

-----. 1995. West Indian manatee *Trichechus manatus*. Biologue Series, U.S. Fish and Wildlife Service.

-----. 1996a. Piping plover (*Charadrius melodus*) Atlantic Coast population revised recovery plan. U.S. Fish and Wildlife Service, Hadley, MA.

-----. 1996b. Recovery plan for seabeach amaranth (*Amaranthus pumilus*). U.S. Fish and Wildlife Service, Atlanta, GA.

-----. 1996c. Florida manatee recovery plan (*Trichechus manatus latirostris*), second revision. U.S. Fish and Wildlife Service, Atlanta, GA.

-----. 1999. South Florida multi-species recovery plan. U.S. Fish and Wildlife Service, Atlanta, GA.

-----. 2000a. 1999 Status update: U.S. Atlantic Coast piping plover population. U.S. Fish and Wildlife Service, Sudbury, MA.

-----. 2000b. Piping plover *Charadrius melodus*, Great Lakes Population, Draft revised recovery plan. U.S. Fish and Wildlife Service, Ft. Snelling, MN.

Valverde, H.R., Trembanis, C. and Pilkey, O.H. 1999. Summary of beach nourishment episodes on the U.S. east coast barrier islands. Journal of Coastal Research, 15(4) 1100-1118. Royal Palm Beach, FL

Watts, B. D., D. S. Bradshaw, and K. Terwilliger. Undated. Dune stability and piping plover distribution along the Virginia barrier islands. Draft ms., College of William and Mary.

Weakley, A. S., and M. A. Bucher. 1992. Status survey of seabeach amaranth (*Amaranthus pumilus* Rafinesque) in North and South Carolina, second edition (after Hurricane Hugo). Report to North Carolina Plant Conservation Program, North Carolina Department of Agriculture, Raleigh, NC and Endangered Species Field Office, U.S. Fish and Wildlife Service, Asheville, NC.

Wilcox, L. 1959. A twenty year banding study of the piping plover. Auk 76:129-152.